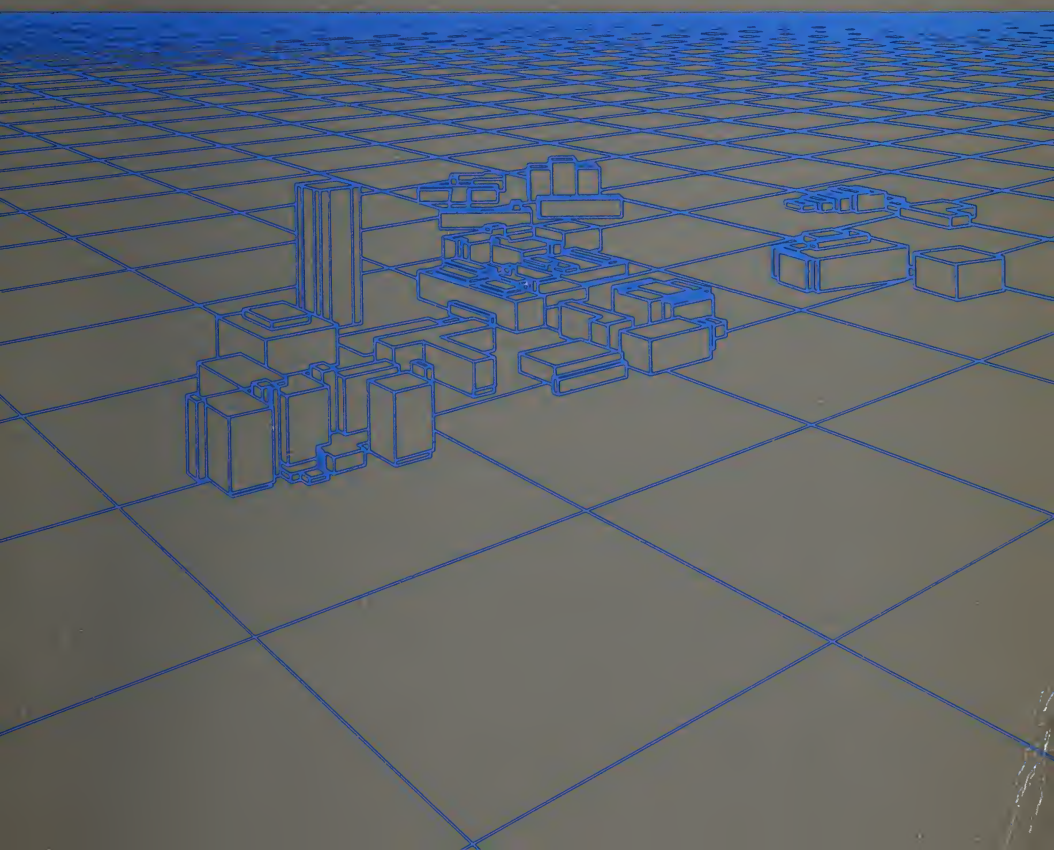


Faculty of Graduate Studies
and Research

Carleton University

Calendar
1985~86





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Carleton University

Faculty of Graduate Studies
and Research
1985-86
Calendar

Carleton University
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Office of the Dean

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Dean of Graduate Studies and Research
S.F. Wise

Associate Dean (Academic)
D.R.F. Taylor

Associate Dean (Research)
J.W. ApSimon

Office Hours

September 1 to April 30

9:00 A.M. to 12:00 noon

1:00 P.M. to 5:00 P.M.

May 1 to August 31

8:30 A.M. to 12:00 noon

1:00 P.M. to 4:30 P.M.

As this calendar is published several months before the opening of the session, the University reserves the right to make whatever changes circumstances may require, including cancellation of particular courses.

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Carleton University

Ottawa, the capital of Canada, is a medium-sized, non-industrial city located at the junction of the Ottawa, Gatineau, and Rideau rivers. Excellent skiing facilities, water recreation areas, and scenic areas are located in the Gatineau Hills a few minutes away from the campus. The National Arts Centre with its own orchestra, the National Gallery of Canada, and other such institutions give the city a well-rounded cultural environment. Entertainment is available in both of Canada's official languages, French and English.

Carleton is a university old enough to have an established reputation, yet young enough to combine its tradition with innovation in ways to meet the diverse needs of modern students.

Founded in 1942 as a non-denominational, private and co-educational college, Carleton initially occupied scattered rented quarters in downtown Ottawa, but by 1946 it had moved to a permanent building in central Ottawa. As the University expanded, it became necessary to plan and develop a new campus located on a large and picturesque site between the Rideau River and the Rideau Canal.

The University awarded its first degrees in 1946, but it did not offer programs of graduate studies until 1954. Carleton's first undergraduate degrees, awarded in 1946, were in journalism and in public administration; its first graduate diploma in 1954 was in public administration. Now, 30 years after the beginnings of its graduate studies, the University also offers graduate instruction leading to the master's degree in some 33 areas and to the doctorate in 14 fields. In 1984-85, Carleton registered 1104 full-time graduate students. In addition, 837 students were registered for part-time graduate studies.

Carleton has set as its major goals in graduate studies the promotion of a spirit of independent investigation and the pursuit of scholarly work of consistently high quality. By concentrating on certain fields of studies to the exclusion of others and by electing areas in which it had a comparative advantage, the University has been able to ensure a great measure of success in the pursuit of these goals.

Carleton University has a good base of operation at the graduate level: outstanding scholars, challenging and imaginative programs of studies, students of high quality, libraries, laboratories and other research facilities. Moreover, the location of the University in the capital of Canada also enables

graduate students to have access to the vast number of scholars working in government organizations and departments, and to take advantage of research and library facilities associated with these national institutions.

Carleton University is a community of faculty, staff and students who are engaged in teaching, learning, and research. Its members are part of the community at large and are governed by the law common to all persons. But membership in the academic community also entails certain rights and responsibilities. The University respects the rights of speech, assembly, and dissent; it prohibits discrimination on the basis of race, ancestry, place of origin, colour, ethnic origin, national origin, creed, sex, age, marital status, family status, political affiliation or belief, sexual orientation, or any handicap that is defined as such in the Human Rights Code of Ontario; it requires tolerance and respect for the rights of others; and it promotes an environment conducive to personal and intellectual growth.

Degree Programs

The following graduate programs are currently offered at Carleton:

Graduate Diploma in Public Administration (D.P.A.)

Master of Arts (M.A.)

In Anthropology, Canadian Studies, Classics, Comparative Literature, Economics, English, French, Geography, German, History, International Affairs, Philosophy, Political Science, Psychology, Public Administration, Religion, Spanish, Sociology, and Soviet and East European Studies

Master of Computer Science (M.C.S.)

Master of Engineering (M.Eng.)

In Aeronautical, Civil, Electrical, Mechanical, and Materials Engineering

Master of Journalism (M.J.)

Master of Science (M.Sc.)

In Biology, Chemistry, Geology, Information and Systems Science, Mathematics, and Physics

Master of Social Work (M.S.W.)

Doctor of Philosophy (Ph.D.)

In Biology, Chemistry, Economics, Engineering (Aeronautical, Civil, Electrical, and Mechanical), Geology, History, Mathematics, Physics, Political Science, Psychology, and Sociology

Academic Dress

The academic dress of Carleton University is a compromise between the style of hoods outlined in the American Intercollegiate Code and the dress of the ancient foundations of Britain and America.

The master's hood, made of black silk, is of simple or Oxford shape with an open lining of two chevrons (red and black) on a silver field. The border of the hood denotes the degree granted, according to the following colour combinations: arts — white; journalism — white with a black cord sewn slightly in from the lower border; science — golden yellow; social work — cream; engineering — orange. The master's gown is of full style, made of black silk or rayon, with full gathered yoke behind and closed sleeves with an opening at the elbows.

The Doctor of Philosophy hood is also made of silk, but completely opened to show the lining, and provided with a purple border. The doctoral gown has the same style as the master's and is made of royal blue cloth with facings of light blue silk.

The gown of the Honorary Doctorate of Laws, of Science, or of Engineering is a blue robe with bell-shaped sleeves, made of fine royal blue cloth with facings and sleeves in light blue silk. The hood is made of the same material as the gown, has the same lining as that for the degrees granted by examination, and is bordered with purple for the degree of Doctor of Laws, dark red for the degree of Doctor of Science, and orange for the degree of Doctor of Engineering.

Academic Schedule

7

The following schedule of dates is anticipated for academic activities and procedures; however, it is subject to final confirmation by the University Senate.

Spring Term and Summer Session 1985

May 13, 14 and 15

Registration for spring term.

May 15

Spring term classes begin.

May 20

Statutory holiday. University closed.

May 31

Last day for late registration for spring term.

Last day for spring term course changes. Students who have not yet deposited the five final copies of their thesis in the Graduate Studies and Research Office *must* register.

June

Spring Convocation for the conferring of degrees; date to be announced.

June 26, 27

First term evening division final examinations may be scheduled as announced.

July 1

Statutory holiday. University closed.

July 2

Registration for summer session day division.
Summer session day classes begin.

July 8

Last day for late registration for summer session.
Last day for summer session course changes.

July 31

Last day for withdrawal from spring term and summer session courses.

August 5

Civic holiday. University closed.

August 9

Last day for spring term and summer session classes.

August 10, 12 and 13

Spring term and summer session examinations.

Fall Term 1985

June 3

Last day for the receipt of applications for fall term registration from candidates whose documents originate outside Canada. Supporting documents (transcripts, letters of reference, etc.) must be received by June 30. Applications from candidates in this category who intend to register initially for the winter term must be received by October 3, and for the spring term by February 3.

August 12

Last day for receipt of applications for fall term registration from candidates resident in Canada. Supporting documents (transcripts, letters of reference, etc.) must be received by September 2. Applications from candidates resident in Canada who intend to register initially for the winter term must be received by November 4; and for the spring term by April 1.

September 2

Statutory holiday. University closed.

September 4, 5 and 6

Registration of graduate students for the fall and winter terms.

September 9

Classes begin in all courses.

September 13

Last day for submission to the thesis supervisor of six examination copies of master's and Ph.D. theses for Fall Convocation. Last day for receiving applications for degrees from potential graduates for Fall Convocation.

September 20

Last day for late registration for fall term. Students who have not yet deposited the five final copies of their thesis in the Graduate Studies and Research Office *must* register.

September 30

Last day for course changes for full-courses and fall term half-courses.

October 9

Last day for submission to the Graduate Studies and Research Office of five final copies of master's and Ph.D. theses for Fall Convocation.

October 14

Statutory holiday. University closed.

November

Fall Convocation for the conferring of degrees; date to be announced.

November 15

Last day for withdrawal from fall term half-courses.

December 1

Last day for receiving applications for degrees from potential graduates for Winter Graduation.

December 6

Last day for fall term classes.

December 7-21

Final examinations in fall courses and mid-term examinations in fall/winter courses, may be scheduled as announced.

April 1

Last day for submission to the thesis supervisor of six examination copies of master's and Ph.D. theses for Spring Convocation.

April 11

Last day for winter term classes.

April 14-30

Final examinations may be scheduled as announced.

April 30

Last day for submission to the Graduate Studies and Research Office of five final copies of master's and Ph.D. theses for 1986 Spring Convocation.

Winter Term 1986

January

Registration for winter term; date to be announced.

January 6

Winter term classes begin.

January 17

Last day for late registration for winter term.

Students who have not yet deposited the five final copies of their thesis in the Graduate Studies and Research Office *must* register.

January 31

Last day for course changes for winter term half-courses.

February 1

Last day for receiving applications for degrees from potential graduates for Spring Convocation.

February 24-28

Study period.

March 1

Last day for receipt of applications for admission from candidates who wish to be considered for the initial award (April 1) of financial assistance (including Carleton fellowships, scholarships, and departmental assistantships) administered by Carleton University. Candidates whose applications are received after the March 1 deadline date may be eligible for the award of a fellowship, scholarship, or assistantship by reversion.

March 14

Last day for withdrawal from full-courses and winter term half-courses.

March 28

Statutory holiday. University closed.

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March							April												
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16	17	18	19	20	21	22							21	22	23	24	25	26	27			
23	24	25	26	27	28	29							28	29	30	31						
30																						

Admission Requirements

Graduates of recognized universities will be considered for admission to the Faculty of Graduate Studies and Research. The University's general policy on admission is outlined below, but all applicants should refer to the departmental statements in this calendar for details concerning the specific or additional requirements of each department, institute, or school.

A combination of factors is taken into consideration in assessing the eligibility of a candidate for admission into one of the graduate programs:

- The performance of the candidate and the assessment provided by his/her referees as a measure of the likelihood that the candidate can successfully complete the course of studies and research defined by the Senate of the University for the given degree
- The capacity of the graduate department, institute, or school to provide a program of studies and research which would meet the expectations of the candidate as defined in his/her statement of academic interests and ambitions
- The availability of a faculty member competent to supervise the academic program of studies and research of the candidate at the time.

Qualifying-Year Program

Applicants who do not qualify for direct admission to the master's program may be admitted to a qualifying-year program. Applicants who lack an honours degree, but have a pass degree with second-class standing (at least B overall) will normally be admitted to a qualifying-year program.

If successful in this qualifying year, they may eventually proceed to the master's program. However, admission to the qualifying-year program does not imply automatic admission to the master's program. At the end of the qualifying-year program, the department will determine the student's eligibility to enter the master's program, and the student will be informed of this decision by the dean of the Faculty of Graduate Studies and Research.

Applicants for a master's degree who have a program requirement of 7½ full courses or more (with the exception of Social Administration) will register initially in the qualifying-year program.

Courses taken to fulfill the requirements of the qualifying-year program may not be used for credit for the master's degree. Courses taken extra to the program requirements of the qualifying year and which have been successfully completed, may be considered for credit towards the master's degree.

Master's Program

For admission to the master's program, applicants must hold an honours bachelor's degree, or the equivalent, with at least high second-class standing (normally B+ or better in honours subject; B- or better overall). The applicant must also be recommended by the department in which he/she plans to undertake his/her studies.

Applicants for a master's degree who have a program requirement of seven full courses or less will register directly in the master's program.

Doctoral Program

For admission to the Ph.D. program, applicants must ordinarily hold a master's degree from a recognized university, with at least high second-class standing (normally B+ or better in honours subject; B- or better overall).

Applicants should note that of the bachelor's, master's, and Ph.D. degrees, only two may ordinarily be taken at Carleton University.

Application for Admission

Applications for admission to the Faculty of Graduate Studies and Research should be made on prescribed forms, available from the major department or the Graduate Studies and Research Office, and they should be submitted directly to the department. To cover administrative costs, a non-refundable charge of \$10 is required with each application.

Deadlines

Candidates whose documents originate outside Canada must apply by June 1. All other applications must be received no later than August 12. Applicants should note that in many academic units application before July 1st is advisable.

Applicants wishing to be considered for financial assistance from Carleton University are reminded that they must submit their completed applications for admission by March 1 (except in the case of the School of Social Work and the Department of Psychology who require completed applications to be submitted before February 1).

Transcripts

Two detailed *official* transcripts of the applicant's entire university record must be sent to the chairman of the department concerned.

Letters of Reference

All applications must be supported by letters of recommendation from at least two faculty members with whom the candidate has studied, who are in a position to assess his/her potential for graduate studies and research. References from non-academic supervisors are not ordinarily acceptable, except in certain cases, such as that of an applicant working in a research laboratory environment. All letters of reference are to be sent by the referees directly to the chairman of the department.

Proficiency in English

Proficiency in English usage is considered necessary to pursue graduate studies at Carleton University. All applicants whose native tongue is not English must be tested for proficiency in the English language, and obtain a minimum score of 550. Tests are administered by TOEFL, Box 899, Princeton, N.J. 08540, U.S.A.

Admissions Procedure

All applications for admission will initially be examined and evaluated by the department, institute, or school in which the applicant wishes to study. All supporting documents (transcripts, letters of reference, etc.) must be received before any application can receive formal consideration.

Completed applications of those students whom the department wishes to recommend for admission will be forwarded to the dean of the Faculty of Graduate Studies and Research for consideration. The dean's office will officially notify each applicant whose admission is approved.

The Statement of Standing on Admission issued to each newly-admitted student is valid only for the 12-month period stipulated on the form. If the applicant fails to register within this period of time, his/her admission and registration eligibility will lapse automatically. He/she may re-apply for admission.

Program Requirements

A description of each program offered under the auspices of the Faculty of Graduate Studies and Research is presented in the departmental program descriptions and details of courses section of this calendar. Prospective applicants should note particularly the admission requirements, the fields in which advanced study and research may be undertaken, and the program requirements of each

department, in addition to the general regulations of the Faculty of Graduate Studies and Research, which are spelled out in this section.

Qualifying-Year Program

Students in the qualifying-year will ordinarily register in five full-courses (or the equivalent) at the senior undergraduate level. Of these five, no more than one course at the 200 level and no more than two at the 500 level may be taken.

Master's Program

The normal requirement for the master's degree is five full courses, or the equivalent, of which at least four (including the thesis where applicable) must be at the 500 level. With departmental approval, the remaining one course may be selected from those offered at the senior undergraduate level, that is, at the 400 level.

Doctoral Program

The period of formal study and research required in the Ph.D. program will normally be at least two years of full-time study (or the equivalent) beyond the master's level.

The thesis will ordinarily carry a weight of about half of the total requirement of 10 full courses or the equivalent.

Ordinarily, all courses taken for credit towards the Ph.D. degree must be at the 500 or 600 level.

Transfer of Credit on Admission

Graduate courses completed at another institution may be accepted in partial fulfilment of Carleton's degree requirements.

Credit for such work will be determined in each case by the Faculty of Graduate Studies and Research, on the recommendation of the department concerned. Master's candidates are allowed a maximum of two transferred full-course credits. In addition, if a master's candidate is granted transfer credit for two full courses, his/her remaining three courses at Carleton must be at the 500 level.

Doctoral candidates may be given up to one year's credit for work completed at other universities, but must normally register for a minimum of one year of full-time studies thereafter at Carleton, and fulfil the thesis and comprehensive examination requirements. Students admitted with transfer of credits in a Ph.D. program may be required to pass a qualifying examination upon entry.

A candidate who has completed courses as a special student is not normally permitted to transfer such courses for degree credit in the Faculty of Graduate Studies and Research.

Special students enrolled in a graduate level course are subject to Special Student regulations outlined in the undergraduate calendar.

Transfer of Credit After Admission

A student formally admitted, and eligible to register in a graduate program, is not permitted to register at Carleton University at the same time in any other graduate program or as an undergraduate or special student. Should he/she do so, credits may not be transferred.

Similarly, if a student, formally admitted to a graduate program at Carleton (but not yet registered), wishes to enrol in courses at another university, credit will be granted only if written permission is received from the dean of Graduate Studies and Research. Such permission must be received in advance of registration for the course work. *In no case will such transfer alter the maximum number of allowable transferred credits noted above.*

Language Requirements

Some graduate programs require a reading knowledge of one or more languages other than English. Language requirements will be prescribed by departments according to their regulations and the needs of their students. Language requirements must be completed within the time limit allowed for the completion of the student's program.

Registration and Course Selection

The Faculty of Graduate Studies and Research divides the calendar year into three terms, and the academic year (September-May) into two terms; each term comprises about 13 weeks of lectures or seminars. The first term of the academic year is designated as the *fall term* (registration period at the beginning of September); the second term of the academic year is designated as the *winter term* (registration period early in January), and the third term of the calendar year is designated as the *spring term* (registration period in late May). Graduate and senior undergraduate courses are also offered in the *summer session*, (registration period early in July) which comprises approximately six weeks of lectures or seminars. The precise dates of registration for the fall, winter, and spring terms, and for the summer session are specified in the academic schedule of this calendar.

All students enrolling at Carleton are required to register in their programs at designated times prior

to the beginning of classes. They will initiate their registration procedures in their major department, from whom information concerning all phases of registration will be available.

Graduate students must have *written approval* from their departmental supervisor of graduate studies for initial course/program registration, and for any subsequent course changes. This approval is also required for any undergraduate student who wishes to register in a graduate-level course.

Credit will be granted only for those courses and research activities for which the candidate is formally registered. An unregistered student is not entitled to attend lectures, tutorials, or seminars, and is not entitled to thesis supervision, examination privileges, or access to research facilities. A student will receive no credit for any work completed during a term in which he/she was not properly registered.

Revocation of Admission or Registration

The University may nullify an admission and revoke a registration if it finds that an applicant for admission or registration has in the process provided false or incomplete information.

Course Selection

A student proceeding to a graduate degree or diploma must arrange his/her program according to the regulations of the Faculty of Graduate Studies and Research and the major department.

The course and thesis requirements of each graduate program are organized or defined in units of full-course credits. A full-course credit typically comprises three hours of lectures or seminars a week for two terms, or the equivalent. A half-course credit typically comprises three hours of lectures or seminars a week for one term, or the equivalent.

Evaluation

To gain standing in a course, a student must meet the course requirements for attendance, term work, and examinations.

Instructors will inform their classes by distributing written notices before the last day for late registration of the elements that will contribute to the final grade and their weighting, including attendance, class participation, essays, tests, laboratories or studio-workshops, or other course-related work assignments, and final examinations.

Supplemental or other grade-raising examinations are not permitted for students registered in the Faculty of Graduate Studies and Research.

Tutorials

These are arranged to allow students to take full advantage of all the resources of the University, even in areas or fields of a very highly specialized nature. Such arrangements are subject to the approval of the supervisor of graduate studies, who will arrange that a document spelling out the details of the topic, reading list, etc., is submitted to the Faculty of Graduate Studies and Research before the last day for course changes in the term concerned.

Audit Courses

Graduate students may register to audit *one full course per program*. Full-time students will not be charged an additional fee; others must pay the prevailing fee for part-time students.

Course Numbering System

Each course is identified by a seven-symbol code. The first two digits indicate the department, school, or committee under whose auspices the course is offered; the three digits following the decimal point identify the specific course; the letter which follows the course number designates the term in which the course is offered; for example, F: fall term, W: winter term, S: spring term, and T: two terms (fall and winter, or winter and spring, etc.). The number which follows the letter indicates the credit weight of the course: 1 denotes one half-course credit, 2 denotes one full-course credit, etc.

Status

A full-time graduate student will normally register in a minimum of three half-courses (or the equivalent) per term.

Part-time students are permitted to enrol in a maximum of two half-courses per term.

All students are reminded that status is established only by formal registration in the appropriate courses for each term of activity in the calendar year.

Whether a student registers on a full- or part-time basis in the thesis, research essay, or independent research project is determined by the amount of time devoted to graduate studies and research, and the demands on university personnel, resources, and facilities.

Definition of Full-time Study

In addition to the *course load* requirements described above, the following criteria for full-time status have been established by the Ontario Ministry of Colleges and Universities:

- Students must identify themselves as full-time

students; that is, they must so register during each term of activity.

- Students must be geographically available and visit the campus regularly; they may not be absent from campus without permission for a period exceeding four weeks in any term. Students wishing to undertake full-time studies off campus must secure, in advance, the written permission of the departmental chairman and the dean of the Faculty of Graduate Studies and Research. (See Off-Campus Research).

- A full-time graduate student may not be regularly employed on work not directly related to his/her program for more than an average of 10 hours per week during any period of full-time registration.

Off-Campus Research

In the interest of enriching their learning experience, graduate students may arrange to undertake full-time studies or research at another institution, or in the field. It should be understood that such activity would apply to only a part of the total program, and that the off-campus period would not normally exceed 12 months.

Requests for permission to undertake full-time off-campus study or research must be submitted, well in advance, to the dean of the Faculty of Graduate Studies and Research, through the department concerned. Such requests should include the following information:

- A detailed statement of the research proposal or program of studies, and the specific arrangements that are proposed for the supervision and direction of the work
- An explanation of the reasons why the work cannot be satisfactorily undertaken while on campus at Carleton
- A description of the studies and/or research facilities that are available at the proposed off-campus location
- A written statement from a responsible official (for example, the on-site supervisor or director) of the outside institution, confirming that the proposed arrangements are satisfactory, and that the candidate will be able to undertake research or studies
- A time schedule for the proposed studies or research work
- A statement of the candidate's expected sources of financial support.

Inter-University Co-operation in Graduate Instruction

Under certain circumstances, it is permissible for a student admitted to a graduate degree program, and

registered at one Ontario university, to follow an approved credit course at another university. All interested students should consult the chairman of their department, prior to registration, in order to obtain further information on procedures and conditions of eligibility.

University of Ottawa

Carleton University and the University of Ottawa have developed a number of joint programs at the graduate level. The details of these are given under the appropriate academic unit later in this calendar.

Where formal joint programs do not exist, a graduate student may be permitted to follow *up to two full courses* at the University of Ottawa. Moreover, there are reciprocal arrangements worked out among departments, institutes, and schools at both universities to involve students, when it is desirable, in parts of the program of research and studies at the other institution. All interested students should consult the chairman of their department, institute, or school, prior to registration, in order to obtain further information on particular departmental conditions of eligibility and procedures.

Continuous Registration

Any candidate who remains unregistered in his/her degree program for three terms (12 months) will lose his/her graduate status.

Continuous Registration in Thesis, Research Essay, or Independent Research Project

Any candidate (full-time or part-time), after initial registration in a thesis, research essay, or independent research project, must maintain this registration in all successive terms (including the term in which the student is examined), until his/her thesis, research essay, or independent research project is completed. Completion means modifications, any retyping involved, etc.

In the case of a thesis, registration must be maintained until five final copies are deposited in the Graduate Studies and Research Office. Should the final copies not be deposited in the Graduate Studies and Research Office by the last day for late registration in a given term, the student will be required to register for that term.

Students should note that faculty approval to register in the thesis, etc., is given on the understanding that the student will be in regular contact with his/her supervisor, and that thesis research will be actively pursued in each term of registration.

Registration by mail is acceptable for part-time students in theses, etc., provided that the pre-

scribed form is completed and returned (through the department concerned) together with fee payment (cheque or money order) before the last date for course changes in each term.

Exemption from Registration

Students who have valid reasons for not registering for a term may apply for permission to remain unregistered by:

- Writing to the dean of the Faculty of Graduate Studies and Research stating the reasons for seeking exemption from registration
- Requesting a statement from the departmental supervisor of graduate studies (and from their thesis supervisor, if there is one) in support of their request, confirming that they will not be on campus for the term, will not use any University facilities (that is, library, laboratories, computer centre, etc.), or receive any supervision, including supervision through correspondence.

It is understood that such an exemption from registration will be granted only in exceptional cases (for example, medical or other special reasons).

Exemptions are normally granted for one term, but in extraordinary circumstances an exemption may be granted for a longer period.

Off-Campus Registration

Students who have been permitted to study off campus, while registered full-time at Carleton, may register by mail. Registration forms may be obtained from the Graduate Studies and Research Office upon request.

Course Changes

A course change is the addition or deletion of one or more individual courses by a registered graduate student. This is the only acceptable procedure for revising or correcting a graduate student's registration. All course changes must be made on prescribed course change forms, which are available at the departmental offices or at the Graduate Studies and Research Office.

The deadline dates for course changes are stipulated in the academic schedule of this calendar.

Withdrawal

A graduate student wishing to terminate his/her registration in a graduate program (that is, drop all courses) must complete the prescribed withdrawal form (or apply in writing to the dean of the Faculty of Graduate Studies and Research) and return his/her identity card.

When a student officially withdraws, at the office of the dean of the Faculty of Graduate Studies and Research, a withdrawal credit will be calculated on a pro rata basis as of the date of receipt of the withdrawal form (or letter). Credit for fees or refunds will depend on the date of withdrawal and the amount of fees originally paid. Students are encouraged to examine the financial implications of withdrawal. A detailed refund schedule is available at the office of the dean of Graduate Studies and Research. (See Withdrawal and Fee Credit, page 27).

Graduate students are cautioned that there is no procedure at Carleton University for direct "mid-term" transfer from one graduate program to another. Similarly, there can be no direct transfer to or from undergraduate or special student status. Any candidate who elects to change programs after registration (*before* the last day of late registration) will be required to withdraw from the first program and then register in the second. The pro rata refund of fees calculated as a result of withdrawal from the first program can be applied against the new fee assessment for the second program.

A registered candidate who completes his/her degree or diploma requirements prior to the last day for withdrawal in any term (as specified in the academic schedule) is required to withdraw formally if he/she anticipates any refund of fees. A candidate whose degree program has been completed is not eligible for further registration in the Faculty of Graduate Studies and Research (unless he/she has been admitted to some other graduate program).

Examinations

Final examinations in courses will be held at the times indicated in the academic schedule. Graduate students must obtain grades that meet the standards outlined in the academic standing section of this calendar, and that satisfy the specific requirements of the department concerned.

A graduate student who is unable to write a final examination because of illness or other circumstances beyond his/her control, or whose performance on the examination has been impaired by

such circumstances, may apply to write a special or deferred final examination. Such an application will be considered only if it is submitted in writing to the dean of Graduate Studies and Research within two weeks of the examination.

If the student has been seen at the University Health Services, the dean's office will confirm the illness by contacting the treating physician. If the student has consulted a physician outside the University, he/she will be required to submit a statement (from the physician) confirming the illness.

In cases other than illness, appropriate documents will be required.

Supplemental or other grade-raising examinations are not permitted for students registered in the Faculty of Graduate Studies and Research. Graduate students may, however, with the permission of their department, repeat a course at the time of next regular offering to obtain higher standing.

Master's Examinations

In addition to any examination which may be required in individual courses, a master's candidate who is writing a thesis will be expected to undertake either an oral defence of the thesis or a comprehensive examination in his field of specialization, or both. The thesis must be submitted, in examinable form, at least two weeks in advance of the thesis examination. When the degree is taken by course work, a comprehensive examination may be required. It is important to note that individual departments may have additional or particular requirements.

Doctoral Examinations

Doctoral candidates may be asked to pass a qualifying examination at the beginning of their residence at Carleton.

A comprehensive examination, covering prescribed fields, will normally be undertaken one year prior to the thesis presentation. This examination (oral or written, or both) may include any material considered fundamental to a proper comprehension of the field of study.

After the thesis has been received and accepted for examination, a final oral examination on the subject of the thesis and related fields will be held. Such thesis examinations will be scheduled upon receipt of theses, which must be submitted at least four weeks in advance of the date of the examination.

Comprehensive and Thesis Examinations

The date, place, and time of comprehensive or thesis examinations will be announced at least two weeks in advance. An examining board will be appointed according to the guidelines laid down by the Faculty of Graduate Studies and Research.

If the comprehensive examination is graded *Unsatisfactory*, the department may permit the candidate to repeat the examination. If the comprehensive examination is graded *unsatisfactory* for a second time, a request by the department that the candidate be allowed to continue in the program would require the approval of the Faculty of Graduate Studies and Research.

The comprehensive and thesis examination processes must be conducted according to the principles and practices prescribed by the Faculty of Graduate Studies and Research. (See Registration and Course Selection)

Grading System

Carleton University employs the 12-point system of letter grades to represent standing in graduate lecture courses, directed studies, seminars, tutorials, and some research essays and theses. The letter grades used, and the grade point equivalents, are as follows:

A+	12	B+	9
A	11	B	8
A-	10	B-	7
C+	6	D+	3
C	5	D	2
C-	4	D-	1

Under certain defined circumstances, notations are used instead of letter grades to represent standing. The only notations permissible in the Faculty of Graduate Studies and Research are the following:

- A notation of *Satisfactory* or *Unsatisfactory* may be assigned, subject to the approval of the Faculty of Graduate Studies and Research, in certain very special courses involving practicum, field work, or other complex activities not easily adaptable to the 12-point system of grading.
- Comprehensive examinations are graded *Pass With Distinction*, *Satisfactory*, or *Unsatisfactory*.
- The master's thesis is graded *Pass With Distinction*, *Satisfactory*, or *Unsatisfactory*, or it may be assigned a letter grade, the oral defence is graded *Satisfactory* or *Unsatisfactory*.

- The Ph.D. thesis and its oral defence are each graded *Satisfactory* or *Unsatisfactory*.
- A notation of *Incomplete* may, subject to the approval of the chairman of the department, be assigned to a course in which the student has been granted the privilege of submitting an assignment after the final deadline date. This notation of *Incomplete* will be permissible only in exceptional cases, (for example, medical or other special reasons) and must be replaced with a letter grade within 40 days of the end of classes. If the notation of *Incomplete* is not changed to a letter grade (through the regular change-of-grade procedures) within 40 days of the end of classes, the notation will remain as a permanent entry for that registration in the course. However, the student may register to repeat the course in order to obtain letter grade credit.
- A notation of *Absent* will be assigned to any course in which the student failed to attend the final examination. If the student explains his/her absence (in writing) to the dean of the Faculty of Graduate Studies and Research within 14 days of that examination, he/she may be granted the privilege of undertaking a special or deferred examination. The notation of *Absent* will also be assigned where a student has terminated a course without formally withdrawing from the course prior to the end of classes; this notation is deemed to be the equivalent of a failure.
- If a thesis, research essay, or independent research project is not completed by the end of the period of registration, a notation of *In Progress* will be recorded. This notation must be replaced by an appropriate final notation or grade (as specified above) after the thesis, research essay, or independent research project has been examined. In cases where a student has registered in a research essay or a thesis, without completing it, and later undertakes course work to complete the degree program — or loses graduate student status in his/her program — the notation *In Progress* will be changed to *Incomplete*.

Release of Grades

A Statement of Marks is mailed to each student as soon as the grades are available after the end of the fall and winter terms of the Fall/Winter session and after the end of the Spring session. Students may obtain a copy of their official transcript by completing a copy of the "Request for Academic Transcript" form which is available in the Faculty of Graduate Studies and Research. Transcripts required for professional and graduate schools should be ordered well in advance of any deadline set by these institutions. Students are advised that no Statement of Marks or official transcripts will be released by the University until all outstanding accounts due have been paid. (See Delinquent Accounts page 27).

Academic Standing

Qualifying-Year Program

Students should note that admission to the master's program from qualifying year is governed by the admission requirements for the master's program outlined on page 11 of this calendar.

Master's Program

A grade of B – or better must normally be obtained in each course credited towards the master's degree. A candidate may, with the recommendation of his/her department, be allowed a grade of C + or C (but not C –) in one full-course or each of two half-courses. Some departments do not permit the C +/C option; students should check carefully to see if the department in question has a B – minimum rule.

Full-time master's candidates who fail to achieve a weighted grade point average of 7.0 after two terms of study, or to maintain it subsequently, will be required to withdraw from the program. In the event of special or extenuating circumstances, the student may apply to the executive committee of the Faculty of Graduate Studies and Research for permission to continue in the program.

A part-time master's student who fails to achieve or maintain a weighted grade point average of 7.0 after completing two full courses (or equivalent) will be required to withdraw from the program.

In addition to the above requirements, departments will undertake a periodic evaluation of a student's progress in his or her overall program of studies and research to determine whether that progress is satisfactory. In the event that progress is deemed unsatisfactory, the Department may recom-

mend to the dean of the Faculty of Graduate Studies and Research that the student be required to withdraw.

Doctoral Program

Doctoral students must normally obtain a grade of B – or better in each course credited towards the degree.

In addition to the above requirements, departments will undertake a periodic evaluation of a student's progress in his or her overall program of studies and research to determine whether that progress is satisfactory. In the event that progress is deemed unsatisfactory, the Department may recommend to the dean of the Faculty of Graduate studies and Research that the student be required to withdraw.

Thesis Requirements

General Remarks

The thesis is a major requirement of most programs and, in conjunction with the research for it, makes up at least one-half of the time normally required for the program. The thesis must be expressed in a satisfactory literary form, consistent with the discipline concerned, and must display a scholarly approach to the subject and thorough knowledge of it. A critical review of previous work related to the subject should usually be given.

A candidate will not be permitted to submit a thesis for which he or she has previously received a degree; however, with the permission of the dean of the Faculty of Graduate Studies and Research, he or she may incorporate into the thesis material that was included in a previous thesis.

Master's Thesis

The master's thesis should embody the results of successful scholarly research in a specialized area. It should exhibit the candidate's knowledge of recognized techniques of investigation and critical evaluation, and be presented in an organized and systematic way.

Candidates are ordinarily required to undertake an oral examination of the thesis. Notice of this examination will be given at least two weeks in advance by the chairman of the department.

The master's thesis will be examined by a board consisting of at least four members, including the thesis supervisor, the chairman of the department concerned, an examiner from a department other than that of the candidate and one additional member from the department concerned.

The constitution of the examining board will be announced by the chairman of the department concerned; both it and the thesis examination process are defined by guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

Thesis weight (one to three full-courses) must be identified at the time of admission. A change in the thesis weight at a later date would require the approval of the executive committee of the Faculty of Graduate Studies and Research.

Faculty regulations governing research essays and independent research projects are normally the same as those for a master's thesis, and subject to the guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

Doctoral Thesis

The doctoral dissertation must report, in an organized and scholarly fashion, the results of original research. The thesis must be a contribution to knowledge, and must demonstrate the candidate's ability to undertake sustained research and to present his/her findings in an appropriate manner.

The dissertation must be defended successfully at an oral examination. Notice of this examination will be given at least two weeks in advance by the dean of the Faculty of Graduate Studies and Research.

The doctoral dissertation will be examined by a board consisting of at least five members, including the thesis supervisor, the chairman of the department concerned, an examiner from a department other than that of the candidate, the members of the candidate's advisory committee, the dean of the Faculty of Graduate Studies and Research or his delegate, and an external examiner who is a recognized authority on the subject of the thesis.

The constitution of the examining board will be announced by the dean of the Faculty of Graduate Studies and Research; both it and the thesis examination process are defined by guidelines, principles, and practices prescribed by the Faculty of Graduate Studies and Research.

Thesis weight (ordinarily about half of the total Ph.D. requirement of 10 full courses) must be identified at the time of admission. If the thesis weight falls within a range of credit weights, it should be assigned at the time of admission a weight corresponding to the lower bounds of that range. A change in the thesis weight at a later date would require the approval of the executive committee of the Faculty of Graduate Studies and Research.

The work of each Ph.D. candidate will be assisted by an advisory committee of faculty members, who will aid him/her in his/her preparation for

the final comprehensive examination, and assist in the evaluation of the thesis and oral examinations.

Deadlines

A master's student expecting to graduate at the Spring Convocation must submit his/her thesis or dissertation to his/her supervisor, in examinable form, by *April 1*. A master's student expecting to graduate at the Fall Convocation must submit his/her thesis by *September 13*.

A Ph.D. student expecting to graduate at the Spring Convocation must submit his/her thesis or dissertation to his/her supervisor, in examinable form, by *April 1*. A Ph.D. student expecting to graduate at the Fall Convocation must submit his/her thesis by *September 13*.

Specifications

- The candidate must submit *six* typewritten copies (original and five acceptable duplicated copies, on bond paper) and must comply with special departmental requirements governing the form of the thesis, including methods of bibliographical entry, and the use of diagrams and tables.
- Each thesis or dissertation must be accompanied by a suitable abstract. The abstract of a master's thesis should not exceed 150 words, while the abstract of a doctoral thesis may be up to 350 words in length.
- Regulations regarding style, pagination, certification, acceptance, grade and size of paper, as well as abstracts, reproduction, microfilming, binding, and the constitution of the examining board will be prescribed by the Faculty of Graduate Studies and Research.

The candidate is expected to notify his/her supervisor and the chairman of the department (at least two weeks in advance) of the date on which he/she intends to submit *six* copies of his/her completed thesis. The thesis examination and defence will then be scheduled and the date will be announced at least two weeks in advance.

The five unbound copies of the approved thesis submitted to the faculty for binding should be the original and four others, and they must be presented in order of pagination in separate envelopes. Two copies are maintained in the library, the third copy is given to the department, the fourth copy is for the candidate, the fifth copy is for the thesis supervisor.

Licence to the University and to the National Library of Canada

In the interest of facilitating research by members of the Carleton community and by interested outsiders,

and in consideration of his/her having been accepted as a graduate student at Carleton, the student author of a thesis or dissertation submitted in partial fulfilment of the requirements for an advanced degree, shall grant to the University and to the National Library of Canada a licence to make single copies or microfilms (solely for the purpose of private study and research, in response to written requests from individuals, libraries, universities, or similar institutions).

It is understood that the student author retains other publication rights, and that neither the thesis, nor the dissertation, nor extensive extracts from them, may be printed or otherwise reproduced without the author's written permission.

Withholding of Thesis Deposition

If, at the time of submitting his/her thesis, the student elects to protect any rights to immediate commercial publication, or to obtain a patent which may arise from his/her research, or to keep his/her thesis out of circulation for other reasons, he/she may apply in writing to the dean of the Faculty of Graduate Studies and Research requesting that the thesis be withheld from deposit in the library:

- For an initial period of three months without reason
- For each additional period of six months, with reason (total period of restriction not to exceed two years).

The student must submit any request for extension of the restriction one month prior to the termination of the previous period. The student and his/her supervisor will be required to justify the extension of the restriction. Subsequent requests must follow the same procedure.

Time Limits

There are maximum time limits for the completion of programs. Candidates may also be subject to time constraints prescribed by individual departments to ensure orderly progress through the stages of their programs.

Master's Programs

Full-time

Full-time master's candidates must complete their degree requirements within six terms of registered full-time study. Students admitted to a 10-course master's program (that is, in the School of Public Administration and the School of Social Work) must

complete their degree requirements within nine terms of registered full-time study.

Part-time

A part-time master's candidate must complete his/her degree requirements within an elapsed period of six calendar years after the date of initial registration. Students admitted to a 10-course master's program (that is, in the School of Public Administration and the School of Social Work) must complete their degree requirements within an elapsed period of eight calendar years after the date of initial registration.

Combined Full-time and Part-time

A master's candidate who elects to complete his/her program by a combination of full-time and part-time study is governed by the following elapsed-time limitation: five calendar years if the candidate is registered as a full-time student for two or three terms and part-time for the balance; four calendar years if the candidate is registered four or five terms as a full-time student and part-time for the balance.

Doctoral Programs

Full-time

A full-time Ph.D. candidate who is admitted on the basis of a master's degree (that is, with a program of 10 full courses or the equivalent) must complete the Ph.D. degree requirements within an elapsed period of six calendar years after the date of initial Ph.D. registration.

Part-time

A Ph.D. candidate who undertakes the program by a combination of full-time and part-time study must complete the degree requirements within an elapsed period of eight calendar years beyond the master's level.

Extension of Time Limit

In exceptional cases, an extension of time (one or two terms) may be granted to a candidate whose recent progress, as judged by the department, has been otherwise satisfactory. Requests for extension of time should be directed to the dean of the Faculty of Graduate Studies and Research through the department concerned.

Grade Review

Within two weeks of the release of grades or the announcement of comprehensive examination results or thesis results, a graduate student may request, through the dean of the Faculty of Graduate Studies and Research, that one or more of his/her grades or results be reviewed. The charge for such a review is \$25, which is refundable if the grade is raised.

Program Review

A graduate student has the right to request a review of decisions made concerning his/her graduate status or any other ruling relating to his/her program. All such requests are to be made in writing to the dean of the Faculty of Graduate Studies and Research.

Appeals and Petitions

A graduate student may appeal the decision of the University to deny the award of degree or the required withdrawal of the student to the Senate upon certain specific grounds.

Such grounds are the allegation by the student that the student has been denied a degree or forced to withdraw because of some mistake, error or improper conduct by the University, its officers or employees.

A graduate student may petition the Senate to grant a degree or to stay a decision of required withdrawal on compassionate grounds.

Such appeals and petitions must be submitted in writing, within ninety days of receipt by the student of the decision which is to be appealed or petitioned, to the Clerk of the Senate, room 607, Administration Building.

Graduation

On the recommendation of the Faculty of Graduate Studies and Research, and with the approval of the Senate of the University, degrees are conferred by the chancellor in the spring and fall of each year. In addition, candidates may have their degrees certified in February each year; they must apply by *December 1*.

Students expecting to graduate at the Spring Convocation must apply for graduation in the Graduate Studies and Research Office by *February 1*. Those expecting to graduate at the Fall Convocation must apply by *September 13*.

Hours of Operation

Bookstore

Labour Day to May

Monday to Thursday 9:00 A.M. — 9:00 P.M.

Friday 9:00 A.M. — 4:30 P.M.

There will be no refunds or exchanges without the Bookstore cash register receipt. Refer to the Bookstore refund/exchange policy, located in the store, for further details.

Business Office

Monday to Friday 9:00 A.M. — 4:00 P.M.

(for payment of account balances)

Evening Service

Labour Day to April 30

Monday to Thursday 5:00 P.M. — 7:00 P.M.

May to Labour Day

Monday and Thursday 5:00 P.M. — 7:00 P.M.

New or replacement I.D. cards are made Monday and Thursday 5:00 P.M. — 7:00 P.M., year-round.

Library

Summer Session

Monday to Thursday 8:30 A.M. — 11:00 P.M.

Friday 8:30 A.M. — 6:00 P.M.

Saturday 10:00 A.M. — 5:00 P.M.

(5:00 P.M. — 10:00 P.M.)*

Sunday 1:00 P.M. — 8:00 P.M.

(8:00 P.M. — 10:00 P.M.)*

*Hours are extended after summer day division begins in July.

Winter Session

Monday to Thursday 8:30 A.M. — 11:00 P.M.

Friday 8:30 A.M. — 6:00 P.M.*

Saturday 10:00 A.M. — 10:00 P.M.*

Sunday 12:00 noon — 10:00 P.M.*

*Week-end hours are extended to 11:00 P.M. during periods of heavy use.

When classes are not in session hours vary and are posted at the entrance.

Alumni Association

The Carleton University Alumni Association is an informal organization which represents the 37,000+ graduates of Carleton University. Membership is automatically extended to all graduates, and is

available, upon request, to students who have completed five full courses but are no longer registered at Carleton.

The Alumni Association serves the University by promoting its well-being through contact with the graduates, the government, the public, the faculty, students, and potential students. It is governed by an elected Alumni Council.

All graduates with known addresses receive the *Alumni News*, published three times a year through the Alumni Relations Office. The Alumni Office maintains alumni records to assure a meaningful and continuing dialogue between alumni and the University.

Alumni are encouraged to support the University by contributing to the Alumni Fund. Contributions to the fund help to support projects which cannot be covered by the University's budget. Funds from alumni help to support the library, student aid, and other specific projects.

The Alumni Association sponsors reunions, an alumni award program, and assists groups who wish to organize functions for alumni. The association is a young organization, and welcomes suggestions for programs and activities that would be of benefit to the University community.

The Alumni Association is located in Room 512 of the Administration Building, telephone 231-3833.

Athletics and Recreation

The athletics and physical recreation program at Carleton, which plays an important role in maintaining and enhancing the University spirit, is determined by the policies established by the Athletic Board, a committee consisting of students, faculty members and administrators.

At the intercollegiate level, Carleton is a member of both the Ontario University Athletic Association (for men) and the Ontario Women's Intercollegiate Athletic Association. Varsity programs for men include basketball, football, cross-country skiing, soccer, waterpolo, rugby, and fencing. The women's teams participate in basketball, volleyball, cross-country skiing, synchronized swimming, field hockey, and fencing. Graduate students are eligible for intercollegiate athletics, subject to league regulations.

The intramural program includes touch football, cross-country running, basketball, broomball, badminton, swimming, curling, squash, team handball,

and hockey. Some of these sports are co-educational, although most are played separately by men and women.

Carleton's athletic facilities currently include football and soccer fields, an outdoor skating rink, five all-weather tennis courts, a 50-metre swimming pool, fitness centre, and a gymnasium complex, which includes such facilities as squash courts, combatives room, gymnastics and multipurpose room, and a gymnasium. These facilities are available for use by Carleton students for organized and recreational sports activities.

Chaplaincy

For the past 20 years there has existed at Carleton a chaplaincy service, part of whose function has been to share with others experiences, insights, friendships, and faith. It has also been involved in study and discussion groups, community projects, development education, marriage preparation, and religious services. The chaplaincy service also has connections with many organizations and resources on campus, as well as with churches and religious groups in the Ottawa area.

The two principal chaplains are the Reverend George Tattre (Presbyterian-Ecumenical), who is located in T28 and T30 Tory Tunnel, and can be reached at 231-3646, and Father Michael Peterkin (Roman Catholic), who can be reached at 237-5616. People are encouraged to visit at any time. Appointments are not necessary, but at times they are advisable and can be arranged by the support staff in the chaplaincy offices.

There is a Quiet Room next to the chaplaincy offices in the Tory Tunnel which is used for individual meditation, religious services, and study-group activity. It is open all day, five days a week. In addition, Father Peterkin exercises a ministry at Newman House, 1061 Bronson Place, that is open to all as a house of hospitality and welcome, and that can also accommodate smaller groups who wish to meet there.

Computing Services

Carleton University Computing Services operates Honeywell CP-6 mainframe computer systems and microcomputer networks running under the CP/M operating system. Both timesharing and batch modes are offered with the emphasis on timesharing: over 1000 computer terminals are available on the campus. The largest of three mainframes, a Honeywell Level

66 computer system, has two processors, 22 megabytes of mainframe memory, and over 1.5 gigabytes of disk storage. It operates under the CP-6 system, which provides a comprehensive range of system services, including networking, inter-system electronic mail, contemporary high-level languages, and database support.

Applications software packages available on the CP-6 system include SPSS, BMDP, SIR/DBMS, and NAG, to name a few. For details on available software packages, please contact the supervisor of User Services at 231-7550.

The Academic Support Group offers a consulting service that ranges from student consultants who are available at two consulting sites on campus at scheduled hours, to senior analysts who are available by appointment.

A statistical advisory service assists researchers engaged in data analysis and statistical computing. In addition to advice on the operation of specialized software packages, this service provides consultation on statistical methodology and the selection of appropriate methods for data analysis. All of this user assistance is supplemented by documentation in the form of Mini Texts (short leaflets written by Computing Services), and reference manuals available in the University Bookstore, as well as an extensive on-line documentation system.

Counselling Services

The University Counselling Services is an educational resource centre available to all members of the University community. A qualified team of counselling professionals offers the wide range of services and programs listed below.

All contacts with Counselling Services are voluntary and strictly confidential. Information is only released upon the request and consent of the client involved.

Other types of assistance include appropriate on- and off-campus referrals when required, and consultation regarding the problems of another person.

The centre is located in Room 1201 of the Arts Tower, with office hours from 9:00 A.M. to noon and from 1:00 P.M. to 5:00 P.M. Further information about services and programs may be obtained from the centre in person, or by telephone at 231-4408.

● Counselling Services

Personal counselling assists people in dealing more effectively with emotional and social concerns. Educational and career counselling involves learning to plan wisely, handle difficulties, and make decisions with regard to academic and vocational

concerns. Individual and group approaches are used in providing counselling and therapy.

- **Testing Service**

A testing program is designed in consultation with a counsellor, and constitutes an individual assessment according to the type of self-knowledge required. Relevant information generated by interest, personality, ability, and test results is used in helping to determine goals and make choices.

- **Information Services**

A resource centre is maintained for use in educational and vocational planning. It includes materials on occupations, university and community college calendars, directories, and other types of career literature. Information regarding other sources of assistance at Carleton and in the greater Ottawa community is also available.

- **Learning Assistance Service**

Various programs and activities are designed to create learning experiences which further the development of effective reading and study skills. Testing, instruction, and practice are provided to correct difficulties, and to improve the ability to learn and study. Individual and group approaches are utilized.

- **Foreign Student Advisory Service**

Counselling concerning any difficulties which a foreign student may experience while at Carleton is available through this service. Student assistance is provided for academic and non-academic difficulties, financial concerns, health and immigration regulations, and adaptation problems. The Foreign Student Advisory Service may be reached at 231-3724.

- **Residence Life Co-ordinating**

Students living in residence can receive counselling in coping with any emotional or social concerns.

- **Group Programs**

These afford opportunities to be involved in a variety of experiences in which learning is best facilitated through group participation. They are offered periodically throughout the year. The nature and content of programs are publicized, along with dates and registration details.

Day Care Centre

The Colonel By Child Care Centre at Carleton operates in two locations on campus, Renfrew House residence and the Loeb Building. The centre is open all year except for statutory holidays, and the hours are from 8:00 A.M. to 5:45 P.M., five days a week.

Currently, the ages of children in the centre are six months to five years.

Inquiries should be addressed to Sandra Thompson at 231-5521 (for children six months to two and one-half years) and Margot Henderson at 231-6312 (for children two and one-half years to five years).

Fees

Fees at Carleton are calculated on a composite basis to include tuition, the Students' Association and the Graduate Students' Association, Athletics, University Centre, and Health Services fees.

The University reserves the right to change all fees, charges, and refund policies without notice.

The fee schedule published below was in effect for the academic year 1984-85 and is subject to change.

Canadian Citizens and Landed Immigrants

- **Full-Time**

Master's Program and Diploma in Public Administration

*(first year of full-time study)

Tuition	\$582.00
Student Sickness/Accident Insurance†;	5.40
Students' Association	20.15
Athletics	25.50
Health	7.40
University Centre	6.65

Total composite fee (per term) \$647.10**

(second or subsequent year of full-time study)

Tuition	\$174.00
Student Sickness/Accident Insurance†	5.40
Students' Association	6.05
Athletics	7.60
Health	2.20
University Centre	2.00

Total composite fee (per term) \$197.25**

Doctoral Program

(first and second year of full-time study; third year of full-time study for students in a 15-course Ph.D. program)

Tuition	\$582.00
Student Sickness/Accident Insurance†	5.40
Students' Association	20.15
Athletics	25.50
Health	7.40
University Centre	6.65

Total composite fee (per term) \$647.10**

(third or subsequent year of full-time study)

Tuition	\$174.00
Student Sickness/Accident Insurance†	5.40
Students' Association	6.05
Athletics	7.60
Health	2.20
University Centre	2.00
<hr/>	
Total composite fee (per term)	\$197.25**

Qualifying Year

Arts, Journalism, and Science	
Total composite fee (per academic year)	\$1,340.40**
Engineering	
Total composite fee (per academic year)	\$1,440.40**

● Part-time

Tuition	\$174.00
Students' Association	6.05
Athletics	7.60
Health	2.20
University Centre	2.00
<hr/>	
Total composite fee (per term)	\$191.85

Foreign Students (In Program)

● Full-time

Master's Program and Diploma in Public Administration

*(first year of full-time study)	
Total composite fee (per term)	\$1,271.10**
(second or subsequent year of full-time study)	
Total composite fee (per term)	\$384.25**

*First and second year of full-time study for students in Public Administration and Social Work.

†The student sickness/accident insurance coverage is based on a one-year period from October 1 to September 30. The insurance fee is payable once a year at registration. Therefore, students who register in September will receive twelve months' coverage and pay only when registering in September. Students who register in January for their first term will receive eight months' coverage and pay at registration. Students registering solely for the summer term will not receive coverage; however, those summer students previously registered in the fall or winter terms will continue to receive coverage over the summer.

**This amount includes the compulsory insurance fee of \$5.40. For students registering in January for their first term, this fee is \$3.60; therefore, the total composite fee for that term is the amount shown less \$1.80. For students registering in May for their first term, there is no insurance coverage; therefore, the total composite fee for that term is the amount shown less \$5.40.

Doctoral Program

(first and second year of full-time study; third year of full-time study for students in a 15-course Ph.D. program)

Total composite fee (per term)	\$1,271.10**
(third or subsequent year of full-time study)	
Total composite fee (per term)	\$384.25**

Qualifying Year

Arts, Journalism, Science, and Engineering	
Total composite fee (per academic year)	\$2,597.40**

● Part-time

Total composite fee (per term)	\$378.85
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An "in program" student is one who has by September 1, 1982 successfully completed, in his/her program, work equivalent to the normal load for a term of a full-time student in that program unless after September 1, 1982 he/she

- transfers more than once to another program at the same level, or
- registers in a program at a different level, or
- changes institutions (Ontario universities, Ryerson and OCA) more than once at the same level.

The "new registrant" fees apply to all other foreign students who are not exempt from the foreign student fee.

Foreign Students (New Registrants)

● Full-time

Master's Program and Diploma in Public Administration

*(first year of full-time study)	
Total composite fee (per term)	\$2,733.10**
(second or subsequent year of full-time study)	
Total composite fee (per term)	\$823.25**

Doctoral Program

(first and second year of full-time study; third year of full-time study for students in a 15-course Ph.D. program)	
Total composite fee (per term)	\$2,733.10**

(third or subsequent year of full-time study)	
Total composite fee (per term)	\$823.25**

Qualifying Year

Arts, Journalism and Science	
Total composite fee (per academic year)	\$4,550.40**

Engineering

Total composite fee (per academic year) \$7,299.40**

- Part-time

Total composite fee (per term) \$817.85

Exemptions for Foreign Students

Subject to the approval of the dean of Graduate Studies and Research, the following categories of foreign students are exempt from the foreign students' fee indicated above, and will instead be assessed the regular tuition fee:

- Persons, or dependents of persons, admitted to Canada under diplomatic visas — Immigration Act, Section 7(1)(A)
- Dependents, excluding the spouse, of a person admitted to Canada on a special visa to practise his or her special profession for a specified period of time — Immigration Act, Section 7(1)(H)
- Persons sponsored and financially assisted by agencies such as the Canadian International Development Agency, the International Development Research Centre, etc.
- Persons studying under a reciprocal exchange agreement recognized by the Ministry of Colleges and Universities.

Persons who believe that they qualify for exemption under one of the foregoing categories must submit documentation, at the time of registration, to support their claim. University personnel will be available at that time to answer any queries.

Method of Fee Payment

Full-time and part-time fees are payable in full, by term. Winter term courses registered for in September are payable on or before January 15.

Scholarships, bursaries, and loans administered by the University will be applied first to fees, provided that this is not contrary to the terms of the award.

Personal cheques will be accepted for the payment of accounts, but the University reserves the right to cancel this policy if it is abused. A service charge of \$5 will be assessed for each cheque returned to the University as non-negotiable for any reason. Students are requested to provide their own cheques when making payments.

A statement of tuition fees paid will be available for income tax purposes by the end of February and mailed to all students who have paid accounts in full. Students will be charged \$2.00 in advance for each duplicate tax certificate requested.

Delinquent Accounts

Registration will not be complete until a satisfactory arrangement has been made for the payment of fees, and it may be cancelled should the student fail to meet these arrangements.

If a student owes the University *any* money at the end of an academic session, his/her account becomes delinquent.

Students with delinquent accounts will not receive examination results, are not permitted to receive transcripts, may not graduate, *and will not be permitted to register again* until all monies have been paid in full by cash or certified cheque.

Withdrawal and Fee Credit

Students who are withdrawing from a course or courses, or entirely from the University, must notify the Office of the Dean of Graduate Studies and Research, either on the specific form designated for the purpose and available from that office, or by letter. The official date of withdrawal is the date on which the notification is received in the Graduate Studies and Research Office. Partial credit of fees for students withdrawing will also be calculated as of that date. No partial credit of fees is available unless all required procedures have been completed by the student on or before the appropriate designated last date for withdrawal.

A withdrawal credit of the composite fee less a registration charge of \$25.00 may be made for withdrawals before the last day for late registration. After the last day for late registration, the tuition portion of the composite fee, less the registration charge, is amortized over the period commencing with the first day of classes and ending the third Friday in November, approximately two-thirds of the term. Students who registered for the fall and winter terms during the fall registration period and who complete all winter term withdrawal requirements by the last date for fall term examinations will receive a credit of the full composite winter term fee.

A detailed schedule of withdrawal credits is available at the Graduate Studies and Research Office.

Miscellaneous fees are not refundable after the last day for late registration. Late registration fees are also not refundable.

The appropriate withdrawal credit will be applied to the student's account and any amounts due at that time will be offset before a refund is prepared.

Following are the last dates for withdrawal with partial credit of fees; application for withdrawal and credit may not be considered if received after these dates:

November 15 (Fall term registration)

March 14 (Winter term registration)

July 31 (Spring/Summer term registration)

Other Charges

Late Registration

Late registration fees are assessed according to the date of completion of registration and are non-refundable.

Full-time Students

- \$10 first week after the regular registration period
- \$15 second and third weeks after the regular registration period.

Part-time Students

- \$5 after the regular registration period.

Appeals

To cover administrative costs, the charge for each appeal is \$25, which is refundable if the appeal is successful.

Application

To cover administrative costs, a non-refundable charge of \$10 is required with each application.

Student Identification Cards

A charge of \$2.00 will be assessed for the replacement of student identification cards. Returning students will be requested to pay this amount at registration in the event that the student's card is not available for validation.

Transcripts

Each student is eligible to receive one free transcript at graduation. All other transcript requests will be processed after payment is made (in advance) to the Business Office, at the rate of \$2 per transcript.

Reinstatement

Students whose files have been closed as a result of failure to observe continuous registration requirements must apply for reinstatement if they wish to continue their studies. If reinstated they must pay a charge of \$25, as well as the current minimum tuition fee for each term in which they have failed to register.

Gowns and Hoods

At each convocation, the University makes available to graduating students the appropriate academic regalia. The regalia will be available at a time and location to be announced in advance.

Graduate Students' Association

Full- and part-time graduate students are members of the Carleton University Graduate Students' Association (GSA). Existing as an autonomous body, the Association represents Carleton's graduate students at several levels and in various forums. The GSA has ties with the Carleton University Students' Association which provides graduate students with a variety of services.

In addition to representing graduate students in several national and provincial bodies, the GSA enjoys a strong relationship with the Ontario Graduate Association (OGA). Internally, the Association carries out numerous activities. GSA officers are representatives on various university bodies. Generally, the GSA seeks to act as a facilitator of productive interaction between the graduate student body and the university community. The GSA runs Mike's Place, a facility located on the second floor of the Unicentre. Adjoining this is the Lewis Lounge, a reading/discussion room provided for graduate students' use.

The Graduate Students' Association office is located in Room 511A of the Unicentre, telephone 231-4347.

Health Services

The function of Health Services is to protect and improve the physical and mental health of the students and of the University community. Its responsibilities are to provide consultation, treatment, and advice on matters of health, and to ascertain the fitness of students to perform academic work. When the necessary service cannot be provided by the program, appropriate referrals will be made. Confidentiality is respected at all times.

Health Services has regular hours and is staffed by physicians, nurses, and psychiatrists. The main clinic is on level six of the University Centre, open from 9:00 A.M. to 5:00 P.M. Appointments may be arranged by calling 231-2755.

After-Hours Service

Students who become ill when the main clinic is closed may contact the after-hours service. A nurse is in attendance from 5:00 P.M. to 9:00 A.M.

Monday through Friday, and 24 hours a day on weekends. Doctors are on call for those persons requiring immediate attention during these hours. Beds are available for persons who require observation for a few hours or overnight.

The service is open from September to May, and is located at 226 Glengarry House; telephone 231-3844.

Co-ordinator for the Disabled

The co-ordinator for this program can arrange for the special services required to meet the needs of those who are disabled. Information is also available for disabled and non-disabled students, faculty, and staff. The co-ordinator may be contacted at 231-3657, or through Health Services at 231-2755.

Health Regulations

Medical insurance is compulsory for all full-time students. It is the student's responsibility to provide the insurance number when receiving medical care.

All Ontario students should be covered by OHIP. Continued coverage is not automatic after the student's twenty-first birthday and it must be applied for in the student's own name. Full-time students may be eligible for premium assistance to help pay the OHIP premium.

Students whose home residence is outside Ontario should have coverage under their own provincial plan. These claims for medical services are processed directly at Health Services.

Students entering Ontario from outside Canada and applying immediately for OHIP coverage will have effective coverage the first day of the month following application.

Tuberculosis Control

On admission to the University, every student requires a tuberculin skin test, or chest X-ray if tuberculin positive. Tuberculin skin tests are administered in Health Services, level six of the University Centre, or at provincial chest clinics.

Immunization Record

It is recommended that new students obtain from their family physician documentation of their immunization status to red measles, German measles, mumps, polio and tetanus.

Housing and Food Services Residences

Residences

There are currently five residence houses on the Carleton campus which accommodate a total of 1,332 students in male, female, and co-educational living arrangements.

Residence accommodation is for full-time graduate and undergraduate students. Graduate and senior undergraduate students are normally accommodated in single rooms. Graduate students are, when possible, given rooms in the graduate suites in Glengarry House, or on the eleventh floor of Glengarry House. Currently, there are no facilities on campus for married students.

Residence applications are sent to students *only* when they are offered admission to full-time study at Carleton.

Off-Campus Housing

An off-campus housing information service is available to students who are unable to obtain or do not wish to have on-campus residence accommodation. The service has been established to assist out-of-town students, but is in no way a rental agency.

Listings of available accommodations are posted in the second-level corridor of the Commons Building. This area is open seven days a week, night and day. Listings of accommodation are not mailed out as such lists become outdated too rapidly.

Food Services

All students residing in residence are provided with 14 meals a week (lunch and dinner). The breakfast plan is optional, and is not included in the residence fees.

Students living off campus may use the residence dining facilities by purchasing a campus dining plan, or eating individual meals in the dining halls. Campus dining plans purchased by students are not subject to provincial sales tax. Additional dining, cafeteria, and vending facilities are located throughout the campus.

For further information, students should contact the Student Housing Office, Room 223, Commons Building.

Library Regulations

All persons registered at the University are entitled to use the library. Graduate students may borrow most books for a period of up to four weeks, although some books are placed on "Reserve", and may be borrowed for five days only, or on an overnight basis. Alumni of Carleton University, on payment of the appropriate fee, and graduates and students of other universities, on payment of the appropriate fee, and at the discretion of the University librarian, may have limited borrowing privileges. The University participates in Ontario and Quebec inter-university borrowing arrangements, which allow students in good standing to borrow directly from other Ontario and Quebec universities.

If books are not returned to the library when due, fines and billing costs will be charged.

The book collection is protected from theft by an electronic detection system, and as a condition of use of the library facilities, all users must, if requested to do so, submit books, briefcases, bags, etc., for inspection at the exit.

Placement and Career Counselling — Canada Employment Centre

The Placement and Career Counselling Service is provided by Employment and Immigration Canada, through the establishment of an on-campus Canada Employment Centre (CEC). The CEC is located in Room 508 of the University Centre, and may be reached by phone at either 231-2600 or 996-9590. The purpose of the CEC service is twofold:

- *To provide students with readily available access to employment opportunities*

To this end, the centre maintains job boards listing part-time, summer, and permanent employment opportunities. Each year the centre also arranges for a large number of representatives from government, as well as from business and industry, both local and national, to recruit at Carleton. While the majority of these visits are for permanent employment, a number of them are arranged for under-graduates seeking summer employment. Students interested in participating in this program are advised to contact the centre upon returning to classes in the fall, as recruiting visits commence early in October.

- *To provide students with information about and assistance in preparing for entry into the labour market*

Individual and group counselling, covering such topics as career areas, labour market trends, the job hunt, and résumé preparation, is available to students seeking or preparing for employment. Students can supplement the counselling provided by reviewing materials maintained in the centre's library, as well as by contacting Counselling Services at the University.

All placement and career counselling information may be obtained by visiting the centre, or by referring to the *CEC Weekly Bulletin* posted throughout the University. The University newspapers and radio station are additional sources for information from the centre.

Student Government

All registered students, full- and part-time, are members of the Students' Association. The Students' Association has many functions: providing services to students, creating community awareness of our campus, and representing student views on a wide range of interests both internally and externally.

The legislative body of the association is the Students' Council, elected in February for a 12-month term beginning the following May. The graduate representative is chosen by the GSA in October. The February election sees selection of the president, finance commissioner, and faculty representatives; the vice-presidents are chosen by the president from among these representatives, and ratified by council shortly thereafter.

The Students' Association provides numerous services, including Oliver's Pub, Rooster's Coffee House, Peer Counselling, the Women's Centre, Information Carleton, the Games Area, The Store, and others. It funds *The Charlatan*, the campus newsmagazine, which is published by the Joint Publishing Board, a CUSA/Charlatan management committee. CUSA also helps fund CKCU-Radio Carleton, an FM station which broadcasts on 93.1, that is heard all over the national capital region and in points of eastern Ontario.

Many Students' Association operations emanate from the University Centre, with policy set by the Students' Council. The Unicentre, open from 7:30 A.M. to 2:00 A.M. most days, includes, in addition to the CUSA operations, facilities for food service, a faculty club, lounges, Health Services, the Canada Employment Centre, and the Ontario Public Interest Research Group (OPIRG).

Students' interests are represented by the association's membership in the Canadian Federation of Students, and by the on-campus work of the Students' Council on issues ranging from government cutbacks to housing shortages and bus-route alterations. To aid in this work, CUSA has a full-time staff, which works to benefit and improve the association and its membership.

The Students' Association offices are located in Room 401 of the Unicentre, and may be reached by phone at 231-4380.

Student Participation in Academic Affairs

New University Government (N.U.G.) is a governing system wherein all faculty members and some students are formally involved in the government of the University at the departmental, faculty board, and Senate levels.

The first level is election to the faculty and departmental boards through a general election among all the graduate students in the various departments. From here, it is possible to get support from a majority of faculty and get elected to Senate.

Awards and Financial Assistance

General Information

Awards Policy

In recent years Carleton graduate students have won a large number of external scholarships, such as SSHRC fellowships and NSERC and Ontario government scholarships. In addition, the University itself provides generous support, and the majority of graduate students receive funds from this source.

Holders of awards must pay regular tuition fees unless otherwise stated.

Full-time graduate students at Carleton are expected to comply with the following procedures:

- Any full-time graduate student who accepts an award that is not directly administered by Carleton University must immediately inform his departmental chairman and the dean of the Faculty of Graduate Studies and Research in writing. This requirement applies to any awards or assistance offered by any agency or institution.
- Any full-time graduate student who accepts part-time employment outside the University is required to inform his departmental chairman and the dean of the Faculty of Graduate Studies and Research, in writing, prior to undertaking the work.

Application Deadlines

March 1 is the last date for receipt of completed applications for admission (including transcripts, letters of reference, etc.) from candidates who wish to be considered for the initial award, announced April 1, of financial assistance administered by Carleton University.

Candidates whose applications are received after the March 1 deadline may be eligible for the award of a scholarship and assistantship by reversion.

Method of Payment

All awards administered by Carleton University will be paid on a monthly basis, with the first instalment on September 30.

Students are urged to note the above payment dates and be prepared to be financially self-sufficient during the month of September.

Other Awards

A number of national and provincial organizations award fellowships and scholarships are tenable at Carleton University (for example, SSHRC, OGS, NSERC, etc.). Some application procedures and regulations concerning fellowships awarded by agen-

cies other than Carleton University are given in the description of each of these awards.

In addition, a large number of foundations, companies, fraternal organizations, and other agencies offer fellowships and scholarships. A booklet providing details of deadlines and application procedures has been compiled and may be consulted in the Graduate Studies and Research Office.

Eligibility

In the case of fellowships, grants, scholarships, etc., for which students must make application, it is the individual student's responsibility to establish his/her eligibility. Should it become known that a student is unqualified for any reason, he/she must return the funds already received, with the University assuming no responsibility.

Departments recommending students for internal awards must accept full responsibility for the eligibility of their nominees.

Students are urged to consult carefully the brochures and announcements which specify the conditions associated with tenure of individual awards. This information is available in the Graduate Studies and Research Office and in departmental offices. An up-to-date listing of awards is published in the Carleton University newspaper, *This Week at Carleton*.

Awards Administered by Carleton University

The awards administered by Carleton University are derived from a variety of sources. Throughout the years, a number of individuals and organizations have contributed substantial funds to the University, through bequests and donations, in order to help support students in various fields of study.

It is not always possible to identify precisely the sources of various donations and bequests (often small, but most important in the aggregate) from which any graduate student's financial support has been constructed. These sums, together with the assistantship funds made available from the University budget, make up the reservoir from which the Carleton scholarships and assistantships are drawn.

In the following cases, however, either because of the relative importance of the contribution or because of the fact that it is earmarked for a specific type of student or program, we do identify the external source from which the award has originated.

Auto-Carto Six Scholarship

This scholarship, in the amount of \$1,000, is awarded annually to a graduate student in geography studying computer-assisted cartography. The scholarship will be awarded, on the recommendation of the Department of Geography, on the basis of academic merit as determined by the academic index used by the Faculty of Graduate Studies and Research.

Walter Baker Fellowship

In honour of the distinguished contribution of the late Walter Baker to Canadian politics, Parliamentary life and public administration, and his long-standing dedication and service to the Ottawa community, Minto Construction Ltd. has established the Walter Baker Fellowship. Valued at \$1,000, it is awarded annually to an outstanding student entering the Institute of Canadian Studies M.A. program. Application is not required; the recipient will be chosen by the graduate awards committee from a list of candidates recommended by the director of the Institute of Canadian Studies.

Fred Barkley Special Bursary

This bursary, in the amount of \$500, is awarded annually to a graduate student from a developing country who requires special financial assistance in order to study at Carleton University. The recipient of the award will be announced by the dean of Graduate Studies and Research each year.

Harold Bernstein Award in Physical Chemistry

This grant, valued at approximately \$1,000, will be awarded annually to a student joining the graduate program of the Ottawa-Carleton Institute to study and do research in the area of physical chemistry. It is a one-time scholarship, and is additional to all other stipends or scholarships that the student may hold.

The award is named in honour of Dr. Harold J. Bernstein, eminent spectroscopist and researcher, who retired from the National Research Council, Ottawa, in 1979. Dr. Bernstein served as an adjunct professor of chemistry at Carleton University from 1970 to 1979.

Peter Browne Memorial Scholarship Fund

This scholarship was established in 1983 by students, friends and colleagues of the late Professor G. Peter Browne. Application for the scholarship is not required. The recipient will be chosen by the awards committee upon the recommendation of the Department of History. Preference will be given to deserving history graduate students who are nearing the completion of their thesis.

R.F. Chinnick Memorial Scholarship

This scholarship is provided by Telesat Canada in memory of R.F. Chinnick, their former vice-president of engineering and operations. It is awarded annually, where appropriate, to a student enrolled in a graduate program in electrical engineering who is working in the field of satellite communications, or whose work has direct relevance to this area of telecommunications.

It is normally awarded in the second or subsequent year of graduate work, when the student's area of specialization has been well established. It may be awarded more than once to the same student, and if an award is not appropriate in a given year, it will be held over so as to allow more than one recipient in a subsequent year.

David and Rachel Epstein Foundation Scholarships

Part of the income from the David and Rachel Epstein Foundation Fund, which was established in 1970, has been designated to provide scholarships for outstanding graduate students at Carleton University.

Up to twenty scholarships valued at \$1,000 will be awarded annually to students from a list of candidates recommended by each department. Application is not required.

Neil Huckvale Memorial Scholarship

This award was established in 1981 by family, friends, and colleagues in honour of Neil Huckvale, a former graduate student in the Department of Geography. The recipient will reflect Neil Huckvale's humanity and philosophy, and will be chosen on the basis of merit and special interest in teaching and resource conservation.

The scholarship will normally be awarded annually to a student enrolled in the third or subsequent term of a graduate program in geography. It may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be selected on the

recommendation of the graduate studies committee. If an award is not appropriate in a given year, it will be held over so as to allow more than one recipient in a subsequent year.

I.O.D.E. Eva Leadley Clark Award

Through the sponsorship of the Amelia F. Sims Chapter, I.O.D.E., a scholarship derived from a legacy by the late Eva Leadley Clark is offered annually to a Canadian citizen entering the Master of Journalism program.

The scholarship, valued at \$1,000, will be awarded to a deserving student who has shown excellent potential in the field of journalism. Preference will be given to a female student.

Zbigniew A. Jordan Scholarship

This award, established in 1978 by friends and colleagues in honour of the late Professor Zbigniew A. Jordan, is open to all graduate students in sociology.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the Department of Sociology and Anthropology on the basis of merit and special interest in sociological theory and the philosophy of social sciences.

The David Lewis Research Honorarium

Established in 1983 by the David Lewis Trust Fund, this \$2,500 research honorarium is awarded annually, when merited, to a graduate student enrolled in the Institute of Canadian Studies M.A. program. It is to assist the recipient in the preparation of a thesis or research essay dealing with the labour movement and/or democratic socialism in Canada.

Candidates are initially screened by the Institute of Canadian Studies and a short list of deserving candidates is submitted to the Board of the David Lewis Trust Fund, the members of which make the final selection of a recipient.

R.A. MacKay Memorial Fund

This fund was established in 1980 by relatives, friends, and former colleagues of the late R.A. MacKay, a distinguished scholar in Canadian government, a senior member of the Department of External Affairs, Professor of Political Science at Carleton University from 1961, and founding associate director of the Norman Paterson School of International Affairs, 1966-68.

The award is intended to assist graduate students from outside Canada who are studying international affairs at Carleton University; they may be enrolled in the Norman Paterson School of International Affairs or come from a related discipline, such as

political science, history, or economics, provided that the "international" component of their course of study is prominent.

R.O. MacFarlane Memorial Book Award

This award is presented annually to an outstanding student registered in a graduate program in the School of Public Administration at Carleton University. Endowed in 1971 by relatives, friends, and graduates of Carleton University, the award is named in honour of the late R. Oliver MacFarlane, first director of the School of Public Administration, 1953-71.

The Dewan Chand and Ratna Devi Marwah Memorial Scholarship in Economics

This scholarship, valued at \$1,000, was endowed by Professor Kanta Marwah of the Department of Economics in honour and memory of her parents. It will be awarded annually to the most outstanding and deserving graduate student, preferably to the doctoral candidate who, having successfully completed all course and comprehensive requirements, is undertaking completion of a dissertation in the field of applied economics.

No application is required. The recipient will be selected by the Scholarship Committee, composed of the chairman of the department, the director of the doctoral studies program in economics, the supervisor of M.A. studies in economics, and Professor Kanta Marwah or her designate. The recipient of the award will be announced in September each year. In a given year, the award may not be made for lack of a suitable candidate.

Violet McLaughlin Scholarship

This scholarship, which carries a value of up to \$1,000, was established in 1984, and is derived from a legacy by the late Violet McLaughlin to graduate students in the School of Social Work.

The scholarship will normally be awarded twice a year to a graduate student who, upon admission, possesses the highest academic standing; and to a student achieving the highest academic standing at the end of the first year of the program.

Application is not required; the recipients will be chosen by the Awards Committee from candidates recommended by the School of Social Work.

Roy Buckley Morrison Scholarship

This scholarship was established in 1979 in honour of the late Roy Buckley Morrison by Panasonic/Matsushita Electric of Canada Limited, and friends and associates. It will normally be awarded to a Canadian

citizen or permanent resident of Canada, registered in the Norman Paterson School of International Affairs.

Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the school on the basis of merit and special interest in conflict analysis and/or studies in strategy and security.

Paterson Fellowships

From the generous support provided by the Honourable Norman M. Paterson when the school was established in 1966, funds are allocated to support some candidates for the M.A. degree in the Norman Paterson School of International Affairs.

All those with high standing who are admitted to this program are considered for these fellowships.

The Norman Pollock Memorial Award for Canadian Jewish Studies

This award, endowed by David A. Pollock and Susan A. Harkavy, will be granted annually to an outstanding graduate student in the Institute of Canadian Studies for research in Canadian Jewish studies. Part of the award may be allocated towards underwriting the cost of publication of this research.

No application is required; the recipient will be selected on the recommendation of the director of the Institute of Canadian Studies. In a given year, the award may not be made for lack of eligible candidates.

The John Porter Publication Grant

This grant, established in 1979 by friends and colleagues of the late John Porter, will be awarded annually and is open to authors of book-length works. The applicants must be members of the Carleton University community whose manuscripts have been accepted by a reputable publisher, or persons not affiliated with Carleton University, whose manuscripts have been accepted for publication in the Carleton Library series.

The award, which carries a value of \$1,000 (to be applied against the costs of publication of the work), will be made on the basis of overall merit and contribution to the literature dealing with aspects of Canadian society. The recipient will be expected to deliver a public university lecture on the topic of the book, at or near the time of publication.

Applications or nominations should be directed to the Grants Committee, appointed by the Vice-President (Academic). The committee may decline to make an award in a given year for lack of meritorious candidates.

William Roxburgh Memorial Award

This award was established in 1981 by Gwenda and Ross Roxburgh, and is open to all graduate students in the Institute of Canadian Studies. The amount of \$100 is provided annually to assist students in carrying out research projects.

Application should be made to the director of the Institute of Canadian Studies; recipients will be chosen from a list of candidates recommended by the director.

John Ruptash Memorial Fellowship

This fellowship was established in 1974 by relatives, former students, faculty colleagues and friends as a memorial to the late John Ruptash, who was dean of engineering and later dean of graduate studies from 1959 to 1973. The fellowship has been awarded annually, beginning in 1975-76, to an outstanding graduate student in the Faculty of Engineering; it may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be chosen by the awards committee from candidates recommended by the Faculty of Engineering.

Social Sciences Graduate Bursary

This fund is made possible by contributions from staff and faculty employees in the Social Sciences. Support up to \$100 is available to graduate students nearing the completion of program and experiencing financial difficulty in meeting the costs of typing/reproduction of an M.A. or Ph.D. thesis.

Application should be made to the chairman/director of the student's department, for referral with recommendations to the Dean of Social Sciences.

TIME Canada Graduate Scholarship in Journalism

Established in 1974, this scholarship, which carries a value of \$1,000, will be granted annually on the basis of academic and professional excellence to a student entering the Master of Journalism program.

Application is not required; the recipient will be chosen from a list of candidates recommended by the School of Journalism.

Philip E. Uren Fellowship

This fellowship is awarded annually to a graduate student in either the Department of Geography or the Norman Paterson School of International Affairs; it may be held in combination with a teaching or research assistantship. Application is not required; the recipient will be chosen by the awards committee from the units involved. The fellowship was estab-

lished in 1980 by relatives, friends, former students, and faculty and staff colleagues as a memorial to the late Philip Ernest Uren who was a professor of geography between 1965 and 1979, and who served the University as chairman of the Department of Geography, director of the Institute of Soviet and East European Studies, director of the Norman Paterson School of International Affairs, and director of the Paterson Centre for International Programs.

Charlotte Whitton Fellowships in Canadian Urban Life

In honour of the distinguished contribution of the late Charlotte Whitton to Canadian urban life and politics, and her long association with Ottawa, up to two fellowships in urban life will be awarded annually to the student(s) in the Institute of Canadian Studies with the highest standing on admission. The proposed field(s) of study must relate to urban life and problems.

The recipient(s) will be chosen by the dean of Graduate Studies and Research on the advice of the director of the Institute of Canadian Studies.

The Susan Joan Wood Fellowships in Canadian Literature

Two graduate fellowships provided for in the will of Susan Joan Wood, an outstanding scholar and student in the field, will normally be awarded annually to candidates for the Ph.D. degree in the Department of English; each fellowship is valued at \$2,500. All students admitted to the Ph.D. program will be considered for the awards; final decisions to be made by the department through its appropriate committee.

Xerox Canada Inc. Graduate Scholarship in Public Administration

This award of \$3,000 is presented annually to an outstanding student entering the first year of the M.A. program in the School of Public Administration. Established in 1980, the scholarship is provided by Xerox Canada Inc.

Graduate Bursaries

A full-time graduate student who experiences *unexpected* financial need, after completion of five weeks from the date of most recent registration, may be awarded a bursary of up to \$500 for the year. Application forms are available from the Graduate Studies and Research Office.

Residence Fellowships

Residence fellowships for men and women, providing free accommodation and meals for one academic year, are available to students of Carleton University.

Applications are invited from graduate and senior undergraduate students with good academic standing.

Application forms may be obtained from the Student Housing and Food Services Office, Carleton University, Ottawa, Ontario K1S 5B6. Deadline is January 30.

Special Bursary for Students in Social Work

This bursary, in the amount of \$1,000 annually, may be awarded to one, or divided between two students in the School of Social Work who require special financial assistance in order to complete their studies at Carleton University. The selection of the recipient(s) will be decided on the recommendation of the director of the School of Social Work.

Awards Tenable at Carleton University

Canada Mortgage and Housing Corporation Scholarships

The Canada Mortgage and Housing Corporation offers graduate scholarships for full-time study in various fields related to housing in its urban and regional context.

This competition is open only to Canadian citizens or landed immigrants who wish to study the social, physical, environmental, economic, legislative, or administrative aspects of housing. The value of a CMHC University Scholarship is \$9,348 per annum personal allowance, plus cost of travel from residence to place of study, university tuition fees, and \$1,424 for each dependent child. The scholarship is tenable at a Canadian university only.

Application forms, which are available in the Graduate Studies and Research Office, must be submitted by February 28 for transmission to CMHC by March 15.

Commonwealth Scholarships and Fellowships

The Government of Canada, through the Commonwealth Scholarships and Fellowships Committee, offers annually a number of scholarships and fellowships, normally tenable for two years, which cover such expenses as travelling costs, tuition fees, other university fees, and a living allowance, to students of other Commonwealth countries.

Under a plan drawn up at a conference held in Oxford in 1959, these scholarships and fellowships are awarded mainly for graduate study, and are tenable in the country making the offer.

Students are advised to consult the Graduate Studies and Research Office for details of the terms of the awards, or to write to the Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1.

Persons intending to apply for the year 1986-1987 are advised to inquire not later than mid-October, approximately one year prior to the date of tenure.

Gulf Oil Canada Limited Graduate Fellowships

Ten graduate fellowships will be awarded annually to candidates in business and management studies, computer sciences, mathematics, geology, geophysics, engineering, physics, chemistry, ecologically-oriented studies, and other sciences related to the petroleum industry.

The fellowships, tenable at any Canadian university or college which is a member, or affiliated member of AUCC, are open to Canadian citizens or landed immigrants. Each fellowship is valued at \$9,000. (\$8,000 will be paid to the successful candidate and \$1,000 will be paid to the relevant department of the receiving university in which the fellow is registered.)

Further information and application forms are available through the Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1. Deadline is February 1.

Imperial Oil Graduate Research Fellowships

Six fellowships are offered by Imperial Oil: three in the pure or applied natural and exact sciences, and three in the social sciences and humanities. These are valued at \$7,000 each per annum for a period of up to three academic years, and are open to any Canadian graduate of an approved university for research leading to the doctoral degree.

Application forms are available from the Graduate Studies and Research Office. Deadline is February 1.

I.O.D.E. War Memorial Scholarships

Ten scholarships are offered annually by the Imperial Order Daughters of the Empire for postgraduate study and research in the humanities or social sciences. The awards are valued at \$11,000 for study in Britain or another country in the Commonwealth, and \$8,500 for study in a Canadian university.

Candidates must be Canadian citizens and graduates of recognized colleges or universities.

Application forms are available from the Graduate Studies and Research Office. Deadline is December 1.

Canada Department of Labour University Research Program

Grants ranging up to \$5,000 a year are provided for research studies in the field of industrial relations and labour economics. Applications are accepted from graduate students and university faculty members, provided they are Canadian citizens or can demonstrate they will be residing in Canada on a continuing basis. Further information and application forms are available from the Secretary, Department of Labour, University Research Committee, Economics and Research Branch, Canada Department of Labour, Ottawa, Ontario K1A 0J2. Applications must be received by February 15.

Sir John A. Macdonald Graduate Fellowship in Canadian History

The Province of Ontario annually offers the Sir John A. Macdonald Graduate Fellowship, valued at \$6,500, for full-time graduate studies and research in the field of Canadian history at the Ph.D. level. The fellowship is tenable for three years, at an Ontario university only, and it will be awarded to a Canadian citizen resident in Ontario.

Application forms and additional information can be obtained from the Graduate Studies and Research Office. The deadline date for submission of completed applications to the dean of Graduate Studies and Research is February 15.

Awards for Research and Study in Mental Retardation

The National Institute on Mental Retardation offers two awards to students entering or pursuing graduate studies: Type A offers up to \$7,500, plus a travel/training award for a one-year period; Type B offers supplementary funding of up to \$2,000 per year for two years. The awards are tenable in a wide area of study, and are not limited to fields directly associated with mental retardation. The deadline for applications for Type A is February 15, and for Type B, April 15.

Department of National Defence Scholarships and Fellowships

The Department of National defence offers scholarships and fellowships for strategic studies of relevance to current and future Canadian national security problems, including their political, economic, social, and military dimensions. Applicants must be Canadian citizens and must, before closing date of the competition, hold a Ph.D. degree or equivalent (for the fellowship) and for the scholarship, a candidate must hold an honours bachelor's degree or equivalent.

Awards are valued at \$18,000 and \$9,000 respectively. Deadline is February 1.

Natural Sciences and Engineering Research Council

NSERC Postgraduate Scholarships (\$11,600 for 12 months, plus travel) are tenable at Carleton University by students undertaking advanced studies and research in science, engineering, experimental psychology, and physical geography.

Students currently enrolled at Carleton University must apply through their departments, on or before November 1, on prescribed forms available from the Graduate Studies and Research Office.

1967 Science Scholarships

NSERC annually offers 1967 Science Scholarships, valued at \$17,500 for 12 months, plus a travel grant.

The university selection committee will determine which, if any, of the candidates for postgraduate scholarships (for a first year of graduate studies) are sufficiently outstanding to be nominated for a 1967 Science Scholarship. Applications (including supporting documents) must be sent to the Graduate Studies and Research Office by November 1.

These awards are tenable in any Canadian university other than the one from which the candidate expects to receive his/her bachelor's degree.

Noranda Fellowships for Postgraduate Studies in Science and Engineering

To stimulate pure and applied research in mining and metallurgy in Canada, the Noranda Group of Companies invites applications for a number of fellowships each valued at \$15,500 per annum.

The fellowships will be granted for research related to mining and metallurgy in the fields of chemical engineering, chemistry, ecology, electrochemistry, extractive metallurgy, forestry, materials science, mineral engineering, mining, and physical metallurgy.

Application should be made through the appropriate university department to the Director of Research and Development, Centre de Recherche Noranda, 240 Hymus Boulevard, Pointe Claire, Quebec, H9R 1G5, not later than February 1.

Ontario Graduate Scholarships

The Province of Ontario annually offers scholarships of \$2,305 per term to students who intend to pursue graduate studies at an Ontario university. Applicants must have maintained an overall average of B+ or the equivalent during their last two years of study.

Application forms and brochures containing details of the award may be obtained from the Graduate Studies and Research Office. The student

should submit completed application forms to their department. The department will advise students of the relevant deadlines.

The Queen Elizabeth II Ontario Scholarships

The Queen Elizabeth II Ontario Scholarship Fund provides a number of annual awards, valued at \$12,000, plus a general expense allowance of \$500, for candidates expecting to be in the final year of their Ph.D. research and writing during their tenure of the award.

The scholarships, open only to Canadian citizens and landed immigrants, are tenable only at Ontario universities. Preference will be given to candidates who are residents of Ontario.

Prescribed application forms are to be completed and submitted to the dean of the Faculty of Graduate Studies and Research by December 1 for transmission to the selection committee by December 15.

J.H. Stewart Reid Memorial Fellowship

This fellowship provides an award of \$5,000 for 12 months for any field of study in a graduate program in any Canadian university. It is open to students who are Canadian citizens, or who have held landed immigrant status from February 1, 1978 and have been admitted to a Canadian graduate program by the time of award. Applications, due February 27, may be obtained from the awards officer, Canadian Association of University Teachers, 66 Lisgar Street, Ottawa, Ontario, K2P 0C1.

Social Sciences and Humanities Research Council of Canada

The council offers fellowships ranging in value up to \$11,340 for studies and research at the doctoral level in the humanities and social sciences.

These fellowships are tenable in Canada or abroad for a maximum of 12 months and may be renewed upon application.

Application forms and brochures containing details of the assistance programs available may be obtained from the Graduate Studies and Research Office, or by writing to the council, P.O. Box 1610, Ottawa, Ontario, K1P 6G4. Applications must be submitted by November 15.

Special M.A. Scholarships and The Queen's Fellowships

To be eligible for these awards, (offered by SSHRC) a student must be nominated by a faculty member of a Canadian university and be in his/her final year of an honours B.A. program (or its equivalent) at a Canadian university, or hold an honours B.A. degree

(or its equivalent) from a Canadian university and not yet have begun a master's program. Nominees must be Canadian citizens, have first-class standing in their present program or previous programs, and intend to pursue full-time graduate studies at a Canadian university.

The value of the award is \$11,340, plus travel allowance for the award holder only, and it is tenable for 12 months. The Queen's Fellowships also include tuition fees. Nomination forms are included in the application forms, which must be submitted by December 1.

Transport Canada Fellowships and Assistantships in Transportation

Transport Canada awards a number of fellowships valued at \$9,000 – \$10,000 for 12 months (master's and Ph.D. levels) for full-time graduate study in any discipline related to transportation.

Applicants must be Canadian citizens or landed immigrants. The awards are tenable at any Canadian university, but in special circumstances doctoral awards may be approved for tenure outside of Canada.

Application forms may be obtained from the Graduate Studies and Research Office, or from Transport Canada (Ottawa). Completed applications must be postmarked no later than January 19.

fully covered by the Canada Student Loans Plan. This provincial loans plan also helps part-time students, or students enrolled in some short courses which are not covered by the other plans.

Students are not obliged to borrow the full amount of their authorized loan under either the Canada Student Loans Plan or the Ontario Student Loans Plan.

Ontario Study Grant Plan

For students who qualify, this plan provides grants to assist with post-secondary education for up to eight terms (or eight grant eligibility periods) of full-time study or its equivalent. Students continuing post-secondary study beyond the eight terms are eligible to apply to the Canada Student Loans Plan and the Ontario Student Loans Plan.

Application forms and a brochure containing details of the plan, including conditions of eligibility, may be obtained from the Awards Office.

Grants and Loans

Ontario Student Assistance Program

Ontario residents who are Canadian citizens or landed immigrants (permanent residents) should apply for financial aid from the Ontario Student Assistance Program (OSAP). The program covers the following plans.

Canada Student Loans Plan

For students who qualify, this plan makes interest-free loans available for post-secondary study. To be eligible for a Canada Student Loan, the applicant must be taking a least 60 percent of a full course load. The amount of loan is based on the student's calculated financial need.

Ontario Student Loans Plan

A student's application for OSAP assistance may be supplemented automatically by the Ontario Student Loans Plan if his/her calculated financial need is not

Departmental

Program

Descriptions

and

Details

of

Courses

Faculty of Arts

Dean: N.E.S. Griffiths

The Department

Chairman of the Department: Marilyn Marshall

Departmental Graduate Co-ordinator: Natalie Luckyj

The Department of Art History offers five courses at the graduate level, under the aegis of the Institute of Canadian Studies.

Graduate Courses*

- Art History 11.501F1

Aspects of Modern Canadian Art

A tutorial to study specific areas of modern Canadian art.

Prerequisite: Honours courses in art history or permission of the department.

- Art History 11.506F1, W1, S1

Directed Reading and Research

Tutorials designed to permit advanced students to pursue topics in Canadian art which they have selected in consultation with the staff.

Prerequisite: Permission of the department and the Institute of Canadian Studies.

Departmental co-ordinator and members of the curatorial staffs, National Museums of Canada.

Courses Not Offered in 1985-86

- Art History 11.500

Aspects of Historical Canadian Art

A tutorial to study specific areas of historical Canadian art.

Prerequisite: Honours courses in art history or permission of the department.

- Art History 11.502

Aspects of Canadian Indian Art

A tutorial to study specific areas of pre-historic, historic, and contemporary Canadian Indian art.

Prerequisite: Honours courses in art history or permission of the department.

- Art History 11.507

Aspects of Inuit Art

A tutorial to study specific areas of prehistoric, historic, and contemporary Inuit art.

Prerequisite: Honours courses in art history or permission of the department.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Institute of Canadian Studies

The Institute

Director of the Institute: R.T. Clippingdale

Associate Director: J.M. Vickers

Co-ordinator, Northern and Native Studies:

G.W. Rowley

Visiting Fellow: Davidson Dunton

The Institute of Canadian Studies offers a program of study and research leading to the degree of Master of Arts in Canadian Studies.

Through the medium of the institute, the following departments co-operate in offering the programs: Art History, Economics, English, Film Studies, French, Geography, History, Journalism, Law, Linguistics, Music, Political Science, Psychology, Public Administration, Social Work, and Sociology and Anthropology.

The Canadian studies program is interdisciplinary in emphasis. It enables students in the institute to develop individual areas of concentration to meet particular interests in a broad range of Canadian issues.

Special areas of concentration include modern Canada; communications; regional studies; urban studies; French-Canadian studies; native peoples; the Canadian north; Canadian art history and music; and studies in Canadian literature.

The proximity of Carleton University to the National Library, the National Gallery of Canada, the national museums, the Library of Parliament, the Public Archives of Canada, Statistics Canada, and the libraries of various government departments and embassies, ensures excellent research facilities for graduate candidates in Canadian studies.

With the aid of a grant from the Donner Foundation, the institute has initiated a new program area of northern and native studies. The same conditions and requirements apply as in other program areas; however, special consideration may be given to candidates for admission who have extensive knowledge of the north or of native peoples, and the language requirement may be met by a demonstrated knowledge of an aboriginal Canadian language in addition to English or French.

In 1983-84, a new program area of women's studies was instituted. Both interdisciplinary and comparative in focus, the program permits students to examine the interplay within the Canadian context between gender and race, gender and nationality, gender and class, and sex/gender as a dynamic principle in the process of imperialism, nation building, and the construction of national and ethnic identities.

Qualifying-Year Program

Applicants with general (pass) bachelor's degrees with second-class standing will be required to complete successfully a qualifying year of study before proceeding to the master's program.

Refer to the general section of this calendar for the regulations governing the qualifying year.

Master of Arts

Admission Requirements

Applicants must normally hold an honours B.A. (or the equivalent), with at least high second-class standing, in one of the disciplines represented in the institute.

Language Requirement

The institute requires a reading knowledge of French from its students. This requirement may be met in one of two ways:

- Successful completion of a 100-level French course or its equivalent, preferably French 20.106 or 20.108
- Successful completion of a language examination.

The institute conducts the language examinations at stated times throughout the year. Students choosing the first option should note that examination results in these courses form part of their record, although they are additional to the course requirements for the degree.

Program Requirements

The minimum requirements for the master's program are outlined in the general section of this calendar. The Institute of Canadian Studies specifies that all candidates must select one of the following program patterns:

- Three full-courses or the equivalent, a thesis, and an oral examination
- Four full-courses or the equivalent, a research essay, and an oral examination.

Whichever pattern is selected, all institute students are required to take the interdisciplinary seminar, Canadian Studies 12.500, 12.510, or 12.520.

Graduate Courses*

- Canadian Studies 12.500T2
Modern Concepts of Canada
Interdisciplinary seminar.
- Canadian Studies 12.510T2
Northern and Native Issues
Interdisciplinary seminar. The significance of the north to Canada, and the position of the native people in Canadian society. The impact of resource development and modern technology on both the north and the native people.
V.F. Valentine and G.W. Rowley.
- Canadian Studies 12.520T2
Women's Studies
Interdisciplinary seminar. The significance in the Canadian experience of sex/gender in the dynamics of imperialism, nation building, class differentiation, and the construction of culture; Canadian feminist theory and the history of women's movements.
J.M. Vickers.
- Canadian Studies 12.590T2, S2
Directed Studies
Reading and research tutorials.
- Canadian Studies 12.591F1, W1, S1
Directed Studies
Reading and research tutorials.
- Canadian Studies 12.592T2, S2
Directed Studies
Reading and research tutorials.
- Canadian Studies 12.593F1, W1, S1
Directed Studies
Reading and research tutorials.
- Canadian Studies 12.598F2, W2, S2
Research Essay
- Canadian Studies 12.599F4, W4, S4
M.A. Thesis

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Selection of Courses

In addition to the graduate courses offered by the institute, the following courses are of particular relevance to students in Canadian studies. The list is not exclusive and is subject to change. Master's students in the institute must complete at least four courses, or the equivalent, at the 500 level, with the possibility of one course at the 400 level.

Anthropology

- 54.516 North American Native Studies
- 54.541 Anthropological Methods
- 54.542 Explanatory Frameworks in Anthropology
- 54.587 Selected Topics in Anthropology

Art History

- 11.400 Canadian Artists and Architects
- 11.403 Contemporary Inuit Art in the Context of Art History
- 11.490 Directed Readings and Research
- 11.491 Directed Readings and Research
- 11.500 Aspects of Historical Canadian Art
- 11.506 Directed Readings and Research
- 11.507 Aspects of Inuit Art

Comparative Literature

- 17.401 Foundations of Comparative Literature
- 17.402 Theories of Literature
- 17.501 Methods of Analysis in Literary Studies I
- 17.502 Methods of Analysis in Literary Studies II
- 17.506 Styles and Periods: Women Writers Around World War I

Economics

- 43.435 Manpower Economics and Labour Policy
- 43.465 Industrial Relations
- 43.480 Urban Economics
- 43.511 Canadian Economy I
- 43.512 Canadian Economy II
- 43.531 Firms and Markets
- 43.533 Regulation and Public Enterprise
- 43.541 Public Economics: Expenditure
- 43.542 Public Economics: Taxation
- 43.581 Regional Economics
- 43.582 Urban Economics

English

- 18.581 Canadian Poetry
- 18.583 Canadian Fiction
- 18.587 Selected Topic in Canadian Literature

Film Studies

- 19.528 Canadian Cinema

French

- 20.546 Genres I: Le roman québécois contemporain
- 20.550 Littérature canadienne-française I
- 20.551 Littérature canadienne-française II

Geography

- 45.421 Selected Themes in Urban Geography
- 45.442 Transportation Geography
- 45.546 Geographical Insights to Canadian Problems
- 45.570 Problems of Development in Arctic and Subarctic Environments
- 45.572 Issues in Canadian Resource Development
- 45.579 Research and Development in Outdoor Recreational Geography

History

- 24.430 The Formation of British North American Societies, 1760-1848
- 24.431 The Making of the Nation, 1849-1896
- 24.437 The National Experience, 1896-1939
- 24.439 Modern Canada, 1939-1976
- 24.442 North American Colonial Rebellions and Independence Movements, 1675-1837
- 24.459 Selected Problems in the History of Women and the Family: From the Industrial Revolution
- 24.491 Directed Studies
- 24.500 A Practicum in Applied History
- 24.531 French Canada since Confederation
- 24.532 Ontario in the Nineteenth Century
- 24.534 Problems in Growth and War in Canada, 1896-1921
- 24.535 Canadian in the North Atlantic World, 1900-1949
- 24.537 The Maritimes in Transition, 1840's to 1890's
- 24.538 The Indian Peoples of Eastern British North America, 1763-1867
- 24.539 Acadian Society, 1604-1967
- 24.559 Women in Nineteenth- and Twentieth-Century North America and Britain
- 24.588 Historiography

Journalism

- 28.411 Selected Problems in Mass-Communication Analysis
- 28.430 Media and Society
- 28.461 Perspectives on Modern Society
- 28.462 Public Issues in Canada
- 28.530 Media Theory: Traditional Approaches and Contemporary Trends
- 28.532 Press and Government

Law

- 51.441 Labour Law
- 51.445 Labour Relations in the Public Service
- 51.450 Canadian Constitutional Law
- 51.456 Administrative Law I
- 51.457 Administrative Law II
- 51.487 Québec Civil Law
- 51.550 The Canadian Constitution
- 51.553 Advanced Legal Problems of Federalism

- 51.556 Advanced Administrative Law Problems
- 51.590 Tutorials/Directed Readings in Law

Music

- 30.510 History of Canadian Music I
- 30.511 History of Canadian Music II
- 30.512 History of Canadian Music III

Political Science

- 47.400 Topics in Canadian Government and Politics
- 47.401 Canadian Public Policy
- 47.402 Policy Seminar: Problems in Northern Development
- 47.403 Politics and the Media
- 47.404 Interest Groups in Canadian Politics
- 47.405 Federalism
- 47.406 Legislative Process in Canada
- 47.407 The Politics of Law Enforcement in Canada
- 47.408 National Security and Intelligence in the Modern State
- 47.409 French-Canadian Politics
- 47.501 Canadian Provincial Government and Politics
- 47.503 Political Parties in Canada
- 47.504 Policy Making in Canada
- 47.506 Problems of Canadian Government and Politics I
- 47.507 Problems of Canadian Government and Politics II
- 47.508 The Politics of Energy and the Environment
- 47.509 Canadian Political Economy
- 47.510 The Political Process in Canada
- 47.511 Canadian Federalism
- 47.520 Nationalism
- 47.521 Politics in Plural Societies
- 47.535 The Canadian and American Political Traditions
- 47.541 Canadian Public Administration and Policy Analysis
- 47.561 Analysis of Canadian Foreign Policy

Psychology

- 49.590 Directed Studies

Public Administration

- 50.500 Public-Sector Managing and the Canadian Political System
- 50.515 Management in the Public Service
- 50.516 Urban and Local Government Management
- 50.565 Government-Industry Policy Relations
- 50.567 Public Sector-Private Sector Relations
- 50.572 Policy Seminars
- 50.584 Industrial Relations and Collective Bargaining
- 50.585 Public-Sector Collective Bargaining

Social Work

- 52.502 Economics of Welfare
- 52.503 Foundations of Sexuality
- 52.504 Social Work and the Law
- 52.506 Women and Welfare
- 52.510 History and Philosophy of Social Welfare
- 52.511 Social Policy Analysis
- 52.514 Housing Policy
- 52.515 Poverty and Wealth
- 52.517 Social Policies for Children
- 52.544 Program Implementation Analysis
- 52.545 Industrial Relations and Social Work

Sociology

- 53.525 Canadian Society
- 53.530 Social Institutions I: Women and the
Canadian Economy: Research and Policy Issues
- 53.532 The Labour Process
- 53.540 Political Sociology
- 53.545 Power and Stratification

Department of Classics

The Department

Chairman of the Department: M.E. Welsh

Departmental Supervisor of Graduate Studies:

R.L. Jeffreys

The Department of Classics offers programs of study leading to the degree of Master of Arts. The following four program categories are available:

- Classics
- Greek only
- Latin only
- Ancient History

Qualifying-Year Program

Applicants who hold a general (pass) B.A. degree will normally be required to complete successfully a qualifying-year program before proceeding to the master's program. Refer to the general section of this calendar for the regulations governing a qualifying year.

Program Requirements

The qualifying-year program will correspond quite closely to the final year of the honours undergraduate program offered by the Department of Classics, although it may include graduate courses.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an honours B.A. degree in Classical Civilization, Ancient History, Classics, Latin, or Greek, with high second-class standing.

Program Requirements

The regulations governing program requirements are outlined in the general section of this calendar. Master's students can complete their program requirements in one of two ways, either by completing two full courses (or the equivalent) at the 500 level and a thesis equivalent to three full courses, or by completing four full courses (or the equivalent) at the 500 level and a research essay equivalent to one full course.

The department also specifies the following:

- Students entering the program with a degree in classical civilization must have one full course

credit in Latin or Greek at the 200 level (or the equivalent) and the other of the two languages at the level of 115 (or the equivalent). A minimum grade of B – will normally be required in these language courses. In special circumstances, the department will allow a student to enter the master's program with less than these requirements, but in that case, the student will have to reach the necessary standard before graduation.

- Students taking the degree in Greek only must have credit in senior matriculation Latin, or an approved equivalent; those in Latin only must have credit in Greek 15.115 (or the equivalent). A minimum grade of B – will normally be required.
- All students must demonstrate a knowledge of German. Credit in German 22.115, or an approved equivalent, will be accepted.

Graduate Courses*

- Classics 14.505F1
Introduction to Linguistics
- Classics 14.506W1
Elementary Textual Criticism
- Classics 14.520T2
A Greek Author
- Classics 14.521T2
A Latin Author
- Classics 14.530T2
A Greek Literary Genre
- Classics 14.531T2
A Latin Literary Genre
- Classics 14.550T2
A Greek Historical Period
- Classics 14.551T2
A Roman Historical Period
- Classics 14.552T2
A Topic in Greek and Roman History
- Classics 14.598F2, W2, S2
Research Essay
- Classics 14.599F6, W6, S6
M.A. Thesis

*F,W,S indicates term of offering.
Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

The Committee

Chairman of the Committee: A.T. Tolley

The Comparative Literature Committee offers programs of graduate study leading to the degree of Master of Arts. These programs, involving courses in comparative literature and, where appropriate, up to two courses from other departments, have considerable flexibility in the sense that they can be tailored to suit each student's special interests in particular periods or areas while, at the same time, through the core half-courses Comparative Literature 17.501 and 17.502 and the final comprehensive, providing a specialized training in the techniques of comparative literature.

The purpose of the comparative literature program is to study literature in its international context, and to relate and compare literary phenomena usually studied in isolation because of linguistic barriers and the traditional departmental division of academic disciplines. Thus, taking into account the interrelation of all humanistic studies, such as the various literatures, philosophy, psychology, sociology, the visual arts, and history, "comparatists" view literary creation within the total complex evolution of world literature. The historical flow of literary archetypes, the role of folklore and myth in literature, recurrent problems of literary theory, and consideration of the less well known literatures of the world are some of the objects of comparative literature studies.

The study of this discipline must be based on a truly comparative perspective, on a solid linguistic foundation, and on an awareness of all difficulties that arise in comparative literature, conceived as a domain both within and beyond the limits of national literatures.

Students registered in other language departments, who wish to register in one or more courses from the comparative literature program, must demonstrate a reading knowledge of the languages required for each course. Such students are encouraged to emphasize their own area of literary study in presentations and essays when the instructor judges that the content of the course(s) so permits. Three years of study at the university level will normally constitute the required level of language proficiency.

Qualifying-Year Program

Applicants who hold only a general (pass) B.A. degree will be required to complete successfully the basic half-courses, Comparative Literature 17.401: Foundations of Comparative Literature and Comparative Literature 17.402: Theories of Literature, and to take courses from other departments of literature, or comparative literature (see undergraduate calendar) to achieve the equivalent of a combined honours B.A. with high second-class standing.

The total course program is to be worked out in consultation with the graduate studies supervisor. Formal admission to the master's program may be considered at the end of the first term.

- Comparative Literature 17.401
Foundations of Comparative Literature
The history of the discipline of comparative literature will be studied, including its beginnings in nineteenth-century France, its evolution, and its current status in Europe, the United States, and Canada.

Prerequisite: Permission of the committee.
G.A. Woods.

- Comparative Literature 17.402
Theories of Literature
The course focuses on twentieth-century literary theories in the context of comparative studies, providing the student with an overall view of the theoretical discussion of literature from about 1920 to the present. Included in the study are Russian Formalism, American New Criticism, and such other approaches as the structuralist, semiotic, socio-cultural and hermeneutic.

Prerequisite: Permission of the committee.
(Students enrolling in this course under the cross-listed 38.402 should note the requirements of the Department of Spanish).
G.A. Woods.

Master of Arts

Admission Requirements

The regulations governing admission to the master's program are outlined in the general section of this calendar.

The specific requirements for admission to the master's program in comparative literature are the following:

- An honours B.A. degree (or the equivalent) with at least high second-class standing, including two full-courses in literature at the senior undergraduate level in each of the two language fields (studied in the original language). Candidates who hold degrees in only one national literature, or in the humanities or social sciences, will be required to take additional courses or to register in the qualifying-year program.
- In addition to proficiency in English, students should have a comprehensive knowledge of either French or German (including the ability to read primary and secondary sources in that language, and to participate occasionally in class discussions in that language).
- A reading knowledge of at least one additional language from among the following: French, German, Spanish, Italian, Russian, Latin, or classical Greek; in special cases, the committee may permit the substitution of some other language. Students accepted into the program who lack this reading knowledge will be required to demonstrate that they have reached the appropriate level before completing the program and receiving the M.A.

Program Requirements

Students accepted into the master's program without having taken the two half-courses, Comparative Literature 17.401 and Comparative Literature 17.402 (or their equivalent), will be required to take these courses as extra to the degree.

The program requirements for master's candidates in comparative literature are the following:

- The two half-courses, Comparative Literature 17.501: Methods of Analysis in Literary Studies I and Comparative Literature 17.502: Methods of Analysis in Literary Studies II.

- *One of the following two combinations:*

Three graduate courses selected from those offered by comparative literature and other departments; (one 400-level course may be substituted for a graduate course) *or*

Comparative Literature 17.599: M.A. Thesis, plus one graduate course

- Comparative Literature 17.593: Comprehensives in Comparative Literature (written and oral).

Course Patterns

Certain course patterns based on offerings by comparative literature and other departments have been drawn up for 1985-86. Students may choose their course options from:

Theories and Techniques of Analysis (Co-ordinator: Stéphane Sarkany)

- 17.510 (Comparative Literature) Special Topic in Modern Fiction: Perspectives on Value and Violence in Fiction
- 17.520 (Comparative Literature) Intertextuality: Literature and Other Cultural Phenomena: Literature and Censorship
- 17.591 (Comparative Literature) Seminar in Comparative Literature: Rhetoric and Literature
- 18.587 (English) Selected Topic in Canadian Literature
- 20.505 (French) Linguistique textuelle
- 20.570 (French) Aspect littéraire culturel particulier
- 29.409 (Linguistics) Seminar in Current Issues in Linguistics

Semiotics (Co-ordinator: R.M. Polzin)

- 17.507 (Comparative Literature) Study of a Theme or Motif: The Double as Theme and as Form
- 17.510 (Comparative Literature) Special Topic in Modern Fiction: Perspectives on Value and Violence in Fiction
- 17.534 (Comparative Literature) Study in Literary Genres: Fiction and the Notion of Character
- 18.400 (English) Structuralism and the Theory of English Literature
- 20.541 (French) Sémiotique littéraire
- 20.561 (French) Sémiotique culturelle

Myth and Archetype (Co-ordinator: F.G. Loriggio)

- 11.480 (Art History) Religious Iconography
- 17.530 (Comparative Literature) Paraliterature. The French Comic Strip
- 18.590 (English) Selected Topic: The Mythopoeic Imagination
- 20.545 (French) Thèmes, écoles, mouvements
- 20.564 (French) Paralittératures

Social, Cultural, and Political Function of Literature (Co-ordinator: Stéphane Sarkany)

- 17.520 (Comparative Literature) Intertextuality: Literature and Other Cultural Phenomena: Literature and Censorship
- 27.411 (Mass Communication) Public Power Policy
- 53.500 (Sociology) Classical Sociological Theory
- 53.536 (Sociology) Cultural Studies

The Third World: Selected Areas (Co-ordinator: V.K. Chari)

Not Offered in 1985-86

Literatures of Small Language Areas (Co-ordinator: Stéphane Sarkany)

Not Offered in 1985-86

Literature of the Americas (Co-ordinator: J.B. Dallett)

- 17.525 (Comparative Literature) Literary Movements in the Nineteenth and Twentieth Centuries: Modernism in British, American and Canadian Poetry
 18.573 (English) American Fiction
 18.581 (English) Canadian Poetry
 18.583 (English) Canadian Fiction
 18.587 (English) Selected Topic in Canadian Literature
 20.505 (French) Linguistique textuelle
 20.550 (French) Littérature canadienne-française I
 38.560 (Spanish) Aspects of Spanish-American Literature after 1888: Games and Play in Spanish-American Fiction
 38.570 (Spanish) Special Problems in Spanish-American Literature: The Prose and Poetry of Nicolás Guillén

Canadian Literature in Multicultural Context (Co-ordinator: Massimo Ciavolella)

- 18.581 (English) Canadian Poetry
 24.531 (History) French Canada since Confederation
 24.538 (History) The Indian Peoples of Eastern British North-America 1763-1867

Medieval (Co-ordinator: Massimo Ciavolella)

- 11.480 (Art History) Religious Iconography
 18.527 (English) Selected Medieval Authors
 20.548 (French) Littérature française I

Renaissance and Baroque (Co-ordinator: C.A. Marsden)

- 11.480 (Art History) Religious Iconography
 38.520 (Spanish) Special Topic on Golden Age Literature: Góngora

Enlightenment, Romanticism and Realism (Co-ordinator: F.G. Loriggio)

- 18.548 (English) Studies in Romanticism
 18.553 (English) Nineteenth-Century Fiction
 20.547 (French) Genres II
 22.567 (German) Period Studies
 38.525 (Spanish) Studies in Eighteenth-Century Literature: Eighteenth-Century Poetry

Modern Literature: Poetry (Co-ordinator: Pierre Laurette)

- 17.525 (Comparative Literature) Literary Movements in the Nineteenth and Twentieth Centuries: Modernism in British, American and Canadian Poetry
 18.581 (English) Canadian Poetry
 20.545 (French) Littérature canadienne
 20.549 (French) Littérature française II

Modern Literature: Drama (Co-ordinator: Angel López-Fernández)

Not Offered in 1985-86

Modern Literature: Prose (Co-ordinator: Stéphane Sarkany)

- 17.506 (Comparative Literature) Styles and Periods: Women Writers Around World War I
 17.510 (Comparative Literature) Special Topic in Modern Fiction: Perspectives on Value and Violence in Fiction
 18.553 (English) Nineteenth-Century Fiction
 18.567 (English) Twentieth-Century Authors
 18.573 (English) American Fiction
 20.505 (French) Linguistique textuelle
 20.544 (French) Auteur(s)
 20.546 (French) Genres I
 20.550 (French) Littérature canadienne-française I
 20.561 (French) Sémiotique culturelle
 22.549 (German) Genres in German Literature
 38.560 (Spanish) Aspects of Spanish-American Literature after 1888: Games and Play in Spanish-American Fiction

In all cases, the committee will prescribe a program of studies that will complement the student's background and special interest.

Graduate Courses*

A prerequisite for all graduate-level courses is appropriate linguistic ability and approval of the Comparative Literature Committee.

- Comparative Literature 17.501FI
 Methods of Analysis in Literary Studies I
 The course deals with linguistic fundamentals of descriptive analysis as practised in the context of comparative literary studies. Emphasis will be put on the structural interdependence of the various layers of analysis: for example, morpho-phonemic, syntactico-semantic, etc., with practical work on poetry and short prose fiction.

Prerequisite: Permission of the committee.

A.W. Halsall.

- Comparative Literature 17.502W1
 Methods of Analysis in Literary Studies II
 Topic for 1985-86: The Narratological Perspective
 The main focus of the course will be narratological

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

theory as it has unfolded after Formalism and Structuralism, particularly developments in the cognitive sciences, artificial intelligence, literary semantics and the philosophy of action and history. Attention will also be given to the problems cinema and theatre pose for narratology. Theoretical texts will come primarily from De Beaugrande, Dolezel, Eco, Greimas, Lotman, Pavel, Ricoeur, Schank, Schmidt, Segre, Van Dijk. Analysis of one-act plays, short fiction and films is included in the curriculum.

Prerequisite: Permission of the committee.
F.G. Loriggio.

● Comparative Literature 17.505W1

Translation Workshop

This course will deal with theoretical as well as practical aspects of translation of poetry. Texts of modern English and French Canadians, and of English and American poets will be studied.

Prerequisite: Permission of the committee.

(Also offered as French 20.507)

Evelyn Voldeng.

● Comparative Literature 17.506T2

Styles and Periods

Topic for 1985-86: Women Writers Around World War I

This course will examine fiction by Scandinavian, English, French, American and Canadian women writers around the time of the first World War. The works will be viewed in a socio-cultural context, and particular attention will be paid to the women in the narrative and to their interrelationships. The texts will be discussed with reference to feminist criticism. Texts by such authors as: Dinesen, Undset, Woolf, Colette, Stein, Montgomery, Salverson.

Prerequisite: Permission of the committee.

G.A. Woods.

● Comparative Literature 17.507T2

Study of a Theme or Motif

Topic for 1985-86: The Double as Theme and as Form

This course will focus on representation of the double (theme of the twins, narcissism, split personalities, etc.) and on forms of formal doubleness (the play within the play, versions of "mise en abyme", etc.). As objects of study, comedy and the novel will be privileged, but some films will also be discussed. The list of authors to be studied includes Plautus, Bibbiena, Shakespeare, Hoffman, Poe, Dostoevsky, Conrad, Gide, Huxley, Pirandello, Nabokov, Robbe-Grillet, Calvino.

Prerequisite: Permission of the committee.

F.G. Loriggio.

● Comparative Literature 17.510T2

Special Topic in Modern Fiction

Topic for 1985-86: Perspectives on Value and Violence in Fiction (Valeur et violence: visions romanesques)

Research on the modern novel inasmuch as it thematizes a fundamental ethical problem: social/anti-social actions under the pressure of desire and justice. Comparative studies on such authors as W. Golding, L.F. Céline, A. Burgess, N. Mailer, G. Garcia Marquez, G. Grass, R. Musil, U. Sinclair, J. Steinbeck, M. Vargas Llosa. Textual analysis in a semiotic perspective will be related to the concepts deriving from the theory of communicative action of J. Habermas (Frankfurt School of Sociology).

Prerequisite: Permission of the committee.

(Depending on the students' linguistic background, the course will be taught either in English or in French).

H.-G. Ruprecht.

● Comparative Literature 17.520T2

Intertextuality: Literature and Other Cultural Phenomena

Topic for 1985-86: Literature and Censorship (La Censure)

The public and secret workings of censorship in the twentieth-century, at the legal, economic, ideological and psychological levels. From official censorship of the theatre and of books at the beginning of the century to today's self-censorship.

Prerequisite: Permission of the committee.

(Depending on the students' linguistic background, the course will be taught either in English or in French).

Stéphane Sarkany.

● Comparative Literature 17.525T2

Literary Movements in the Nineteenth and Twentieth Centuries

Topic for 1985-86: Modernism in British, American and Canadian Poetry

A comparative historical study of the development and influence of modernism in British, American and Canadian poetry. The course will in part be structured in terms of contrasts between poets who were rough contemporaries in the three cultures, such as Hopkins and Whitman, or Lowell and Larkin.

Prerequisite: Permission of the committee.

(Also offered as English 18.561)

A.T. Tolley.

● Comparative Literature 17.530F1

Seminar in Comparative Literature

Topic for 1985-86: Paraliterature — The French Comic Strip

The status of the comic strip in literature. Visual communication and narration. Ideology and the imagination.

Prerequisite: Permission of the committee.

(Also offered as French 20.564)

Pierre Laurette.

● Comparative Literature 17.534W1

Study in Literary Genres

Topic for 1985-86: Fiction and the Notion of Character

The course will analyze the modalities and status of characters in myth or historiography, in short stories or in novels, in drama, and in epic or lyric poetry. Various perspectives – sociological, psycho-critical or formalistic – will be explored.

Prerequisite: Permission of the committee.

A. W. Halsall.

● Comparative Literature 17.593F2, W2, S2

Comprehensives

● Comparative Literature 17.596T2

Directed Special Studies

From time to time, students whose main interests are not covered by courses offered in a given year may pursue independent research, subject to the availability of a qualified adviser and relevant library resources at Carleton. Interested students should apply to the supervisor of graduate studies.

● Comparative Literature 17.598F1, W1, S1

Directed Special Studies

From time to time, students whose main interests are not covered by courses offered in a given year may pursue independent research, subject to the availability of a qualified adviser and relevant library resources at Carleton. Interested students should apply directly to the supervisor of graduate studies.

● Comparative Literature 17.599F4, W4, S4

M.A. Thesis

Courses Not Offered in 1985-86

17.561 Studies in Literary Genres

17.590 Seminar in Comparative Literature

17.591 Seminar in Comparative Literature

Department of English Language and Literature

The Department

Chairman of the Department: Douglas Wurtele
Departmental Supervisor of Graduate Studies:
R.H. MacDonald

The Department of English offers programs of study leading to the M.A. degree in English Language and Literature. Additional information may be obtained by consulting the departmental supervisor of graduate studies.

Qualifying-Year Program

Applicants who hold a general (pass) B.A. degree with at least B standing, with a major in English language and literature, may be admitted to the qualifying-year program. Normally, these students will be required to complete four or five full courses (or the equivalent) in English, as determined by the department, and to maintain at least high second-class standing before being considered for admission into the master's program.

Master of Arts

Admission Requirements

The minimum admission requirement for the master's program is an honours B.A. (or the equivalent) in English Language and Literature, with at least high second-class standing, and including at least five of the following areas:

- History of the English Language or General English Linguistics
- Old English or Middle English
- Renaissance Literature
- Drama (including Shakespeare)
- Restoration and Eighteenth-Century Literature
- Romantic and Nineteenth-Century Literature
- Twentieth-Century Literature
- Canadian Literature

Possession of the minimum entrance standing is not in itself, however, an assurance of admission into the program.

Program Requirements

Each candidate will select one of the following optional program patterns:

- Three full courses (or the equivalent) in English, including English 18.597: Special Topic Studies,

selected from those offered at the 500 level (except English 18.598), and a master's thesis; an oral examination on the thesis and related fields will also be undertaken.

- Five full courses (or the equivalent) in English, including English 18.598: Directed Special Studies, selected from those offered at the 500 level (except English 18.597).

Under certain conditions, one of the optional courses in either program pattern may be selected from those offered by the department at the senior undergraduate level in a field for which no graduate course is available. One of the optional courses may also be a cognate course at the graduate or the senior undergraduate level, offered by another department; however, not more than one undergraduate course may be included in the total program.

All candidates are required to demonstrate a reading knowledge of one language other than English, approved by the department.

Academic Standing

A standing of B – or better must be obtained in each course counted towards the master's degree.

Doctor of Philosophy

A Ph.D. program specializing in Canadian literature has been offered since 1979-80. At present the Department is not accepting any new applicants into this program.

Graduate Courses*

- English 18.500T2
Literary Criticism
A study of specific topics or particular areas of literary criticism.
- English 18.527S1
Selected Medieval Authors
A study of certain portions of Chaucer's *Canterbury Tales*.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- English 18.548T2
Studies in Romanticism
A study of selected major Romantic poets.
- English 18.553T2
Nineteenth-Century Fiction
A study of selected fiction writers of the nineteenth century.
- English 18.561T2
Twentieth-Century Poetry
Modernism in British, American and Canadian Poetry.
A comparative historical study of the development and influence of modernism in British, American and Canadian poetry. The course will in part be structured in terms of contrasts between poets who were rough contemporaries in the three cultures, such as Hopkins and Whitman, or Lowell and Larkin.
(Also offered as Comparative Literature 17.525)
- English 18.566S1
Twentieth-Century Literature
A study of selected twentieth-century authors.
- English 18.567F1
Twentieth-Century Authors
A study of selected twentieth-century authors of fiction.
- English 18.573T2
American Fiction
A study of selected twentieth-century American novelists.
- English 18.581S1, W1
Canadian Poetry
A study of selected Canadian poets.
- English 18.583T2
Canadian Fiction
A study of selected Canadian writers.
- English 18.587W1
Selected Topic in Canadian Literature
The development of Canadian drama with emphasis on the work of Coulter, Reaney, Ryga, and Tremblay.
- English 18.588T2
Studies in Canadian Literature
A study of a selected theme or topic in Canadian literature.
- English 18.590T2
Selected Topic
The mythopoeic imagination: a study of myth and symbol in the works of selected authors, including Shakespeare, Defoe, Dickens, Melville, Kipling and Robertson Davies. Particular attention will be paid to principles and problems of myth criticism.

- English 18.597T2, S2
Special Topic Studies
All thesis students will be assigned to an adviser (normally their thesis supervisor) for special tutorials in the general area of their thesis research.
- English 18.598T2, S2
Directed Special Studies
All students in the M.A. course program will be assigned to an adviser who will direct their area of special studies, preparing them for an oral examination in that area.
- English 18.599F4, W4, S4
M.A. Thesis
- English 18.699F10, W10, S10
Ph.D. Thesis

Undergraduate Courses

Graduate students may take *one* of their courses at the senior undergraduate level.

Other Disciplines

Graduate students may take *one* of their five courses in a related discipline. The following courses may be among those of special interest:*

Comparative Literature

- 17.401 Foundations of Comparative Literature
- 17.402 Theories of Literature
- 17.501 Methods of Analysis in Literary Studies I
- 17.502 Methods of Analysis in Literary Studies II
- 17.506 Styles and Periods: Women Writers Around World War I
- 17.507 Study of a Theme or Motif: The Double as Theme and as Form
- 17.590 Seminar in Comparative Literature: Introduction to the Study of the Folktale

*This is not a complete list of all the acceptable options. Students should contact the supervisor of graduate studies or the chairman for approval if there are other courses they wish to take which are not on this list.

Other Universities

Graduate students may take up to *two* of their five courses at another university or other universities and receive credit towards a Carleton M.A.. Students are especially reminded that the University of Ottawa offers a wide range of graduate courses which may be completed (under the general two-course ruling) for credit at Carleton.

Courses Not Offered in 1985-86

- 18.501 Bibliography and Textual Editing
- 18.518 Old Norse
- 18.521 Middle-English Poetry
- 18.522 Middle English
- 18.528 Middle-English Studies
- 18.531 Renaissance Poetry
- 18.532 Seventeenth-Century Poetry
- 18.534 Renaissance Drama
- 18.537 Renaissance Authors
- 18.538 Renaissance Studies
- 18.542 Eighteenth-Century Prose and Poetry
- 18.543 The Eighteenth-Century Novel
- 18.551 Nineteenth-Century Poetry
- 18.558 Nineteenth-Century Literature
- 18.563 Twentieth-Century Fiction
- 18.564 Twentieth-Century Drama
- 18.568 Twentieth-Century Studies
- 18.571 American Poetry
- 18.576 American Literature
- 18.578 Studies in American Fiction
- 18.585 Canadian English
- 18.591 Selected Topic
- 18.594 Special Studies in Dramatic Literature
- 18.680 Literary Criticism in Canada
- 18.681 Studies in Canadian Literature I (Poetry)
- 18.683 Studies in Canadian Literature II (Fiction)
- 18.687 Studies in Scholarship
- 18.688 Comparative and Contextual Studies

The Department

Chairman of the Department: George McKnight

The department does not offer a program of studies at the graduate level, but does offer a course at the graduate level, under the aegis of the Institute of Canadian Studies.

Graduate Courses*

- Film Studies 19.528T2

Canadian Cinema

Through a close analysis of films from both cultures, this course should establish the distinctly Canadian modes our cinema has developed. Special attention will be paid to the similarities and differences between English Canada and Québec, relating them both to the economic and political realities of our country, and to the variety of thematic orderings of Canadian culture that can be found now in the writings of Northrop Frye, Margaret Atwood, Ronald Sutherland, Robin Mathews, John Moss, and others.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of French

The Department

Chairman of the Department: Sinclair Robinson

Departmental Supervisor of Graduate Studies:

D.W. Smith

The program of studies leading to a Master of Arts degree in French consists of courses (one-half credit each) covering the fields of French linguistics, linguistic analysis of literary discourse, literary history and literary criticism. The availability of a great variety of courses and the existence of 20.580, 20.590 and 20.599, in which the student establishes course content in consultation with his/her adviser allow for considerable flexibility and choice in wide ranging or highly specialized studies.

Qualifying-Year Program

Applicants who hold a general (pass) bachelor's degree with at least B standing or higher, with a major in French, will be required to register in the qualifying-year program (normally five courses in French chosen from those numbered at the 400 level), and maintain at least B+ standing overall, before proceeding to the M.A. program.

Qualifying-year students should consult the undergraduate calendar for a listing of 400-level courses.

Master of Arts

Admission Requirements

The normal requirement for admission into the master's program is an honours B.A. in French with at least high second-class standing (normally B+ or better in honours subject; B- or better overall).

Program Requirements

Students will establish their programs in consultation with an adviser from the department who will normally be the professor with whom they are taking 20.590: Etudes dirigées, or 20.599: M.A. thesis, which are requirements.

The following two patterns are available:

- Four credits, of which at least three must be chosen from courses at the 500 level; and a directed special studies option (20.590), with an oral examination

- Three credits, of which at least two must be chosen from courses at the 500 level; and a master's thesis equivalent to two credits (20.599), with an oral examination.

With the approval of the department, master's students in French may select a comparative literature course in partial fulfilment of their program requirements.

Academic Standing

A grade of at least B- must be obtained in each course counted for credit towards the master's degree.

Graduate Courses*

The graduate courses offered by the department are open to students in the M.A. program and, with permission of the department, to students in the qualifying-year program. For prerequisites, please consult the department.

1985-1986

- French 20.505F1
Linguistique textuelle
Lexicologie. Analyse des champs conceptuels et des champs lexicaux.
Pierre Laurette.
- French 20.506F1
Linguistique du français langue seconde
Perception et compréhension du langage; théorie de l'acquisition; l'apprentissage en fonction des actes de langage; recherche sur la pédagogie intégrée de langue première et de langue seconde; applications au niveau de la didactique.
J.J. van Vlasselaer.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

● French 20.507W1

Traduction: théorie et pratique

Poésie et traduction. Après une introduction théorique, exercices pratiques de traduction de textes poétiques de l'anglais vers le français (poètes canadiens-anglais, anglais, américains) et du français vers l'anglais (poètes du Québec et de la francophonie).

Prerequisite: Permission of the department and of the Comparative Literature Committee.

(Cours 17.505 offert par le Comparative Literature Committee)

Evelyn Voldeng.

● French 20.520F1

Aspect linguistique particulier

Problèmes de stylistique. Etude de style d'auteurs, du système des figures, de l'argumentation rhétorique, etc. Pour chacun de ces cours il est exigé des prérequis en linguistique, différents selon le cours donné.

Pierre van Ruten.

● French 20.541W1

Sémiotique littéraire

Les types d'humour et leur réalisation dans l'écrit moderne. Analyse narratologique, pragmatique et sociale des textes de Queneau, Marcel Aymé. Pierre Daninos et Robert Escarpit.

Stéphane Sarkany.

● French 20.542F1

Théories générales de la littérature

Théories et analyses narratologiques. Aperçu critique des principales théories narratologiques post-structuralistes: Barthes et la sémiotique textuelle; Booth, Chatman et la rhétorique narrative; Ricoeur, temporalité et intrigue, etc. Analyses des récits courts.

A.W. Halsall.

● French 20.544W1

Auteur(s)

Hubert Aquin romancier et essayiste.

Patricia Smart.

● French 20.546W1

Genres I

Le Nouveau Roman, phénomène de l'avant-garde.

Etude de la théorie et de la pratique du Nouveau Roman (A. Robbe-Guillet, N. Sarraute, M. Butor).

Le Nouveau Roman comme manifestation de

l'avant-garde. Théorie de l'avant-garde.

E.N. Zimmerman.

● French 20.547W1

Genres II

Le conte fantastique en France, de Nodier à Maupassant. Le récit de phénomènes étranges en

contradiction avec les lois connues régissant le monde extérieur; définition du genre et des genres voisins, le merveilleux, le surnaturel, le "surnaturel expliqué"; le bestiaire fantastique, les phénomènes de l'inconscient. Auteurs: textes de Nodier, Gautier, Maupassant, et *Anthologie du conte fantastique français*, de P.-G. Castex.

E.F. Kaye.

● French 20.548W1

Littérature française I

La légende de Tristan et Iseut. La version "commune" (*Tristan* de Béroul et *Folie de Berne*) de la légende, étudiée par rapport au contexte littéraire et aux institutions sociales de l'époque (XIIe siècle). Jean Miquet.

● French 20.549W1

Littérature française II

Lautréamont et Rimbaud, tradition et modernité. Ce qui les distingue de leurs prédécesseurs et de leurs contemporains, ce ne sont ni les thèmes qui sont des lieux communs, ni le style qui use des procédés de la rhétorique classique, de l'impressionisme ou du symbolisme, c'est plutôt l'écriture: ce qui fait que *Les Chants de Maldoror* et *Les Illuminations* se présentent comme un objet d'écriture.

E.F. Kaye.

● French 20.550W1

Littérature canadienne-française I

L'essai au Canada français.

Michel Gaulin.

● French 20.561F1

Sémiotique culturelle

Les agréments du voyage moderne: la technologie au service des plaisirs. Récits et réflexions sur des voyages réels et imaginaires: textes de Ch.-L.

Philippe, V. Larbaud, P. Morand, Simone de Beauvoir, M. Butor.

Stéphane Sarkany.

● French 20.563W1

Littérature et les autres arts

Etude de quelques œuvres littéraires portées à l'écran. Comparaison des moyens d'expression littéraire et cinématographique. Transposition de l'écriture à l'image, etc.

Renato Galliani.

● French 20.564F1

Parallittératures

La bande dessinée d'expression française: imaginaire et idéologie.

Prerequisite: Permission of the department and of the Comparative Literature Committee.

(Cours 17.530 offert par le Comparative Literature Committee)

Pierre Laurette.

● French 20.570W1

Aspect littéraire culturel particulier
Montaigne: *Essais* (Livre III). Définition de la pensée de Montaigne: ses idées morales, religieuses, politiques. Analyse de l'art de l'écrivain: la technique littéraire des *Essais* (structure, langue, images).
H.P. Clive.

● French 20.580F1, W1, S1

Tutorial
Sujet établi sur proposition de l'étudiant en consultation avec son conseiller.

● French 20.590T2, S2

Etudes dirigées
Tout(e) étudiant(e) qui ne fait pas de thèse, choisira un directeur d'études avec qui il/elle préparera un mémoire d'une cinquantaine de pages sur un sujet de son choix. Ce travail sera sanctionné par un examen oral.

● French 20.599F4, W4, S4

M.A. Thesis

Graduate Courses*

1986-1987

- 20.501 Théories linguistiques françaises
- 20.502 Linguistique du français I
- 20.503 Linguistique du français II
- 20.504 Linguistique du français canadien
- 20.506 Linguistique du français langue seconde
- 20.541 Sémiotique littéraire
- 20.543 Littérature et idéologie
- 20.544 Auteur(s)
- 20.545 Thèmes, écoles, mouvements
- 20.546 Genres I
- 20.547 Genres II
- 20.548 Littérature française I
- 20.551 Littérature canadienne française II
- 20.562 Littérature, société, communication

The Department

Chairman of the Department: Jutta Goheen
Departmental Supervisor of Graduate Studies:
 E.M.Oppenheimer

The Department of German offers programs of study leading to the degree of Master of Arts. These include courses on all major periods in German literature, genres, themes, and a number of individual authors, as well as on aspects of literary theory and the study of the German language. The Age of Goethe figures prominently in the teaching and research of the department, which offers a favourable setting for specialized studies in this period.

Admission Requirements

Departmental requirements conform to those outlined for master's students in the general section of this calendar. Further information concerning graduate work in German may be obtained from the department.

Program Requirements

Master's students in German normally will be required to select and follow one of the following optional program patterns:

- Three full courses (or the equivalent) and a thesis
- Four full courses (or the equivalent) and a research essay
- Five full courses, or the equivalent.

While these courses will normally be courses offered by the department, permission, where appropriate, may be granted for enrolment in one course from the program of the Comparative Literature Committee.

German 22.590 is an obligatory course for all graduate students (full-course credit).

All master's students are also required to undertake a comprehensive examination, based on a departmental reading list.

Selection of Courses

The following senior undergraduate courses are open to students in the qualifying-year program who, with the approval of the department, may also take certain other undergraduate courses.

- German
- 22.441 German Literature of the Sixteenth Century
- 22.452 Goethe II

- 22.469 Selected Authors of the Nineteenth Century
- 22.471 Seminar on a Selected Topic
- 22.481 The German Novel in the Twentieth Century

For 400-level courses not offered in 1985-86, see the undergraduate calendar.

Graduate Courses*

- German 22.549F1
 Genres in German Literature
 Satire, fantasy, and the poetics of scale: Musil, Bobrowski, (Kafka, Robert Walser).
 Basil Mogridge.
- German 22.567F1
 Period Studies
 Romantic Poetry: Novalis, Tieck, Eichendorff, Brentano and others.
 Robert Gould.
- German 22.574W1
 Individual Authors
 Goethe's Early Dramas: *Urfaust*, *Götz von Berlichingen*, *Egmont* und *Tasso*.
 Robert Gould.
- German 22.576W1
 Individual Authors
 Grimmelshausen *Simplicissimus*: *Auslegungsver-suche*.
 Joseph Dallett.
- German 22.590T2
 Directed Studies
 An obligatory course of supervised study in preparation for the comprehensive examination.
- German 22.591F1, W1, S1
 Special Topic
 Tutorial.
- German 22.598F2, W2, S2
 Research Essay
- German 22.599F4, W4, S4
 M.A. Thesis

*F,W,S indicates term of offering.
 Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Courses Not Offered in 1985-86

Genres in German Literature

- 22.541 Struktur des modernen Romans
- 22.542 The emblematic tradition
- 22.543 Novelle des 19. Jahrhunderts
- 22.544 The German idyll from Gessner to Mörike
- 22.547 Radical poetics
- 22.548 Deutsche Erzählprosa zwischen Reforma-
tion und Aufklärung

Prevalent Themes in German Literature

- 22.550 Myth in drama

Period Studies

- 22.560 Dichter und Tradition in mittelalterlicher
Lyrik
- 22.561 Drama in the nineteenth century
- 22.562 Literaturtheorie im 20. Jahrhundert
- 22.565 Rhetorik in mittelalterlicher Dichtung
- 22.566 Prominent works of the fifteenth- and
sixteenth centuries
- 22.568 The convergence of lyrical and dramatic
elements in works by Hauptmann, Hofmannsthal,
Rilke, George, and selected Expressionists
- 22.569 Naturlyrik der Aufklärung

Individual Authors

- 22.572 Heinrich von Kleist
- 22.573 R.M. Rilke
- 22.575 Keller
- 22.577 *Faust II*

Linguistic Problems

- 22.581 Applied linguistics: pedagogic grammar of
German
- 22.582 Mittelalterliches Deutsch
- 22.583 Sprachwandel im Neuhochdeutschen

The Department

Chairman of the Department: R.C. Elwood
Departmental Supervisor of Graduate Studies:
D.A. Muise
Associate Supervisor: J.K. Johnson

The Department of History offers programs of study leading to the degree of Master of Arts in Canadian, American, British, Modern French, Modern Russian, International (diplomatic), and Medieval History. It also offers a program of study and research leading to the degree of Doctor of Philosophy in Canadian History.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an honours bachelor's degree (or the equivalent) with at least high second-class standing.

The department offers no qualifying-year program; applicants with a general (pass) degree may be considered for admission into the fourth year of Carleton's honours B.A. program.

Program Requirements

Candidates may follow either a thesis or a non-thesis program, as follows:

- History 24.588 or 24.589:
a seminar or tutorial in the historiography of the appropriate country or area (one credit)
- History 24.500:
a practicum in the applied uses of history (one credit)
- a graduate history seminar in the student's major field of concentration (one credit)
- *Either* History 24.599:
thesis (two credits); *or*
- History 24.598:
research essay (one credit) *plus* one additional seminar (one credit), which may be chosen from those offered at the graduate or 400 level by the Department of History, by another department at Carleton University, or by the Department of History at the University of Ottawa.

Language Requirements

All candidates are required to demonstrate a reading knowledge of a language other than English, the choice to depend upon the field of the candidate's thesis or research. For seminars dealing with sources not in English, a reading knowledge of the appropriate language will be required *before* registration. Details may be obtained from the supervisor of graduate studies.

Doctor of Philosophy

Admission Requirements

Applicants with an M.A. degree will be expected to have at least high second-class standing.

An applicant with an honours bachelor's degree who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Ph.D. program directly. Such candidates will be required to complete at least 15 full courses, or the equivalent.

Residence Requirements

- A minimum of three years of full-time study after the B.A. honours degree, or two years after the M.A.

Program Requirements

Candidates will be responsible for three fields: a major field in Canadian history, and two minor fields. The latter are usually chosen from among American history, British history, or an aspect of European history; one of these may be a transnational topic, or in a related discipline. Each of the three fields covers approximately one century. Written examinations will be taken in the two minor fields after two terms of study; an oral examination concentrating on the major field will be arranged after three terms.

Admission to History graduate seminars is normally restricted to graduate students in the department and to others who have successfully completed two full upper-level undergraduate History courses or the equivalent in the general area of the seminar, or who have received permission of the department.

A reading knowledge of French will be required. The language examination will be written early in the first post-M.A. year, and before the candidate is permitted to take the doctoral field examinations. Proven competence in an additional language may be required if it is pertinent to the candidate's program.

Students entering the program with an honours B.A. will normally complete:

- History 24.588: Historiography of Canada
- History 24.591: Directed Studies in a Canadian Field
- History 24.592: Directed Studies in a Non-Canadian Field
- and two other graduate seminars in their first year.

Students entering the second year (that is, the first post-M.A. year) will normally be required to follow:

- History 24.688: Social History
- History 24.690: Preparation for a Ph.D. oral examination in Canadian history (equivalent to two full credits)
- Two of

History 24.610: Directed Studies in an Aspect of Modern European History; History 24.640: Directed Studies in United States History; History 24.650: Directed Studies in British History; an approved course of studies in a related discipline appropriate to the candidate's field. Candidates may take an appropriate 500-level seminar.

With other requirements completed, doctoral students will be required to write a thesis on a topic related to Canadian history (five credits).

University of Ottawa

A Carleton University student may take one seminar in the Department of History at the University of Ottawa, with permission of the two departments. The following graduate seminars are available in various years:

- 5300 Directed Studies in Canadian History
- 5400 Directed Studies in Canadian History
- 5402 New France: Problems in the Interpretation of Colonial History
- 5405 The History of the Left in Canada, 1867-1960
- 5406 The Union of the Canadas, 1839-1867
- 5414 Lower Canada 1760-1840
- 5700 Études dirigées en histoire du Canada
- 5702 Textes relatifs à l'histoire sociale de la Nouvelle-France
- 5705 Rapports intellectuels du Canada français avec l'extérieur au XIX^e siècle
- 5800 Études dirigées en histoire du Canada
- 5802 Problèmes en histoire sociale de la Nouvelle-France
- 5807 Études dirigées en histoire du Québec
- 5814 Le Bas-Canada, 1760-1840
- 6302 Seminar on United States Foreign Relations in the Nineteenth and Twentieth Centuries
- 6303 Seminar in American History
- 6403 Seminar in American History
- 7300 Directed Studies in European History

7390 Problems in European Diplomatic History, 1815-1914

7400 Directed Studies in European History

7412 Seminar in Economic History of Colonial America

7691 La transition de l'ère pré-industrielle à l'ère industrielle, en Europe, aux XVIII^e, XIX^e siècles. Économies et sociétés

7700 Études dirigées en histoire européenne

7704 Séminaire en histoire sociale

7800 Études dirigées en histoire européenne

7891 Histoire des organisations internationales en fonction des idéologies du monde contemporain

Graduate Courses*

Most, but not all of the graduate seminars (History 24.500 through 24.588 and 24.688) are offered each year, but none is available during the summer. The directed studies and thesis courses (History 24.589 through 24.690) are always offered during the academic year, and are frequently available during the spring and summer terms as well.

- History 24.500T2

Practicum in Applied History

Study of the practical uses of history in such fields as archival management, museum research, oral history, journal editing, quantitative investigations, and contract research.

D.A. Muise and members of the department.

- History 24.505T2

Law and Society in Medieval England

J.G. Bellamy.

- History 24.516T2

The French Revolution, 1788-1804

A sound reading knowledge of French is required for admission.

M.J. Sydenham.

- History 24.531T2

French Canada since Confederation

A study of topics relating to the political and social history of French Canada and to problems of cultural duality.

H.B. Neatby.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- History 24.532T2
Ontario in the Nineteenth Century
J.K. Johnson.
- History 24.534T2
Problems of Growth and War in Canada, 1896-1921
M.J. Barber and R.T. Clippingdale.
- History 24.535T2
Canada in the North Atlantic World, 1900-1949
An examination of Canada's changing relationships with Great Britain and the United States.
- History 24.536T2
Science and Technology in the Canadian Experience
An examination of the role and relationship of science and technology, including their social and engineering applications, in the Canadian historical experience.
J.H. Taylor.
- History 24.537T2
The Maritimes in Transition, 1840's to 1890's
A seminar on social and economic themes. Quantitative approaches and comparative themes with Central and Western Canada will be encouraged.
D.A. Muise.
- History 24.538T2
The Indian Peoples of Eastern British North America, 1763-1867
S.F. Wise.
- History 24.539T2
Acadian Society, 1604-1967
N.E.S. Griffiths.
- History 24.540T2
The Age of the American Revolution, 1730-1815
P.J. King.
- History 24.557T2
Community in Early Modern England, 1450-1600
R.B. Goheen.
- History 24.558T2
Reform and Society in Mid-Nineteenth-Century Britain
J.N. Cooper.
- History 24.559T2
Women in Nineteenth- and Twentieth-Century North America and Britain
An examination of the role and image of women in the context of social and economic development and of the family in North America and Britain.
M.J. Barber and Deborah Gorham.
- History 24.560T2
Revolutionary Russia, 1898-1921
An examination of various primary sources available for research on revolutionary Russia. A sound reading knowledge of Russian is required for admission.
R.C. Elwood.
- History 24.580T2
Problems in International History: Polarization and Cold War, 1917-1950
J.L. Black.
- History 24.588T2
Historiography of Canada
A seminar, primarily for graduate students in Canadian history, which examines the trends and methods of Canadian historical writing, and the influences upon it.
S.R. Mealing.
- History 24.589F2, W2, S2
Historiography
A course of directed studies in one of the following fields:
Modern France
The intensive study of selected problems in the writing of modern French political and social history.
M.J. Sydenham.
Britain
The intensive study of a range of selected problems in the writing of sixteenth-century or nineteenth-century English history.
R.B. Goheen or J.N. Cooper.
Modern Russia
Concentrated reading in Russian intellectual history and supervised study of Russian historiography, with emphasis on the nineteenth and early twentieth centuries.
R.C. Elwood and J.W. Strong.
United States
A course in which the trends and methods of historical writing on the United States will be examined.
P.J. King.
International History
A course in which the trends and methods of historical writing on international history will be examined.
J.L. Black and R.A. Jones.

Medieval History

Historical method and historiography of an aspect of the Middle Ages.

J.G. Bellamy.

- History 24.591T2, S2

Directed Studies in a Canadian Field

A program of supervised reading and preparation of written work in an area not covered by an existing graduate seminar.

- History 24.592T2, S2

Directed Studies in a Non-Canadian Field

(same description as 24.591)

- History 24.593F1, W1, S1

Directed Studies in a Canadian Field

(same description as 24.591)

- History 24.594F1, W1, S1

Directed Studies in a Non-Canadian Field

(same description as 24.591)

- History 24.598F2, W2, S2

M.A. Research Essay

An examination of an approved topic in Canadian, American, British, modern French, modern Russian, international, or medieval history.

- History 24.599F4, W4, S4

M.A. Thesis

A substantial historical investigation. The subject will be determined in consultation with the department, and a supervisor will be assigned.

The candidate will be examined orally after presenting his/her thesis.

- History 24.610T2, S2

Directed studies in one of the following aspects of modern European history: modern France (M.J. Sydenham), modern Russia (R.C. Elwood and J.W. Strong), and international history (J.L. Black and R.A. Jones).

- History 24.640T2, S2

Directed Studies in United States History

P.J. King.

- History 24.650T2, S2

Directed Studies in British History

J.N. Cooper.

- History 24.688T2

Social History

A course, primarily for doctoral candidates in history, in which the literature and methodology of basic aspects of social history will be examined.

S.R. Mealing and members of the department.

- History 24.690F4, W4, S4

Directed Studies in Canadian History

A program of supervised reading with several instructors in preparation for the Ph.D. oral examination.

- History 24.699F, W, S

Ph.D. Thesis

The School

Director of the School: G.S. Adam

Supervisor of Graduate Studies: Peter Johansen

The School of Journalism offers courses leading to the degree of Master of Journalism. The emphasis in the M.J. program is on advanced professional education for those who are or intend to become practising journalists in the news media, but there is provision for students who wish to undertake research in journalism and mass media.

Students who wish to complete a non-professional degree in media and society are advised to consult with the Institute of Canadian Studies; it is possible to work out an M.A. program in these areas under the joint supervision of the institute and the School of Journalism.

Students entering the master's program will choose one of three areas of concentrated study:

Specialized Reporting

Courses provide advanced training in specialized news beats in journalism, such as politics, the economy, or international affairs.

Specialized Media

The focus of this specialty will be techniques of television, radio and documentary film. Students will be expected to work to standards of professional competence.

Media and Society

This specialty encompasses a number of topics, among which are the law of the press, journalism history, government-press relations, issues in contemporary journalism, such as those raised by the ownership and control of publishing and broadcasting in Canada, and an examination of the role of the media in society as it is conceived by selected social and political theorists.

Carleton's School of Journalism is uniquely situated for advanced journalism study. It offers ready access to many of the people and institutions that most directly influence Canadian affairs: Parliament, federal government departments and agencies, embassies, business and labour organizations, and major economic and cultural institutions are close at hand.

Qualifying-Year Program

Applicants who have three-year (pass) journalism degrees with high second-class standing may be admitted to a qualifying-year program, made up largely of courses from the Faculty of Arts. An applicant with a background in another discipline, who does not have a journalism degree or the equivalent, may be admitted to a qualifying year of basic professional studies if he or she achieved at least a B average in the previous degree.

Students who complete a qualifying-year program with high second-class standing may proceed with master's level studies the following year.

For details of the regulations governing qualifying-year programs, please refer to the general section of this calendar.

Master of Journalism

Admission Requirements

Admission to the M.J. program is selective. The basic requirement is an honours B.J. degree with at least high second-class standing or its equivalent. Long and distinguished professional experience may also serve as a basis for admission. Applicants who combine an undergraduate degree (not in journalism) and professional experience will also be considered for admission.

The school will consider the applicant's undergraduate background and/or professional experience in assigning a program of studies.

As a condition for graduation, all students are required to have a minimum of four months of practical experience in the media, and a working knowledge of a second language, preferably French.

Graduate Courses*

Students are required to complete successfully five full courses or the equivalent. They will have their work evaluated at the end of each academic term, and those working below a B- level will normally be asked to withdraw.

In 1985-86 most courses will be prescribed and students will be required to complete:

● Journalism 28.530F1

Media Theory: Traditional Approaches and Contemporary Trends

This course examines the major approaches to the analysis of the mass media. It will include discussion of the utility of each approach in making sense of the relationship between the structure of the media and the structure of modern society.

Eileen Saunders.

● Journalism 28.532W1

Press and Government

A critical examination of the press in the political systems of Britain, the United States, and Canada. The course will include a research component.

G.S. Adam.

● Journalism 28.540T2

Specialized Reporting

A series of seminar-workshops on approaches and problems in one area of reporting, such as politics, international affairs, labour, science, or finance. (Certain of these specialities may not be offered every year.)

Anthony Westell.

● Journalism 28.599F4, W4, S4

M.J. Thesis

The student will complete a substantial piece of public affairs journalism in any medium, *or* a research project on the mass media, *or* make a major contribution to journalism education through the production of a document on an aspect of journalism practice.

The courses described above constitute four of the required five credits. Students will choose from among the following options to complete their course requirements:

● Journalism 28.551W1

Communications Law

This intensive course is concerned with the general laws governing the mass media in Canada, with attention to their effect on freedom of expression. Specific topics for examination include contempt of court; free press, fair trial; revealing of sources; civil defamation; criminal libel; obscenity and censorship; copyright; privacy; government secrecy; and the law of advertising. (This course may not be taken by students who have completed 28.351, or 51.351, or 28.451.)

● Journalism 28.588F1

Directed Readings

Students, working under faculty direction, will undertake an intensive reading schedule in order to pursue a subject area of particular interest.

● Journalism 28.589W1

Directed Research

Students, working under faculty direction, will develop and undertake a research project in order to pursue a subject area of particular interest.

● Journalism 28.590T2, S2

Directed Studies

Reading and research tutorials.

● Journalism 28.591F1, W1, S1

Directed Studies

Reading and research tutorials.

With the approval of the school and the participating department, M.J. students may take a full-course or two half-courses elsewhere in the university.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

The Department

Chairman of the Department: Jaromira Rakusan

The Department of Linguistics does not offer a program at the graduate level, but does offer opportunity for independent study to students in the Institute of Canadian Studies and other Departments in the areas of linguistic study of the Cree, Iroquois, and Inuit languages, Canadian English and Canadian French dialectology, applications of linguistics in first-language education, and the teaching of English as a second language. Members of the department are also prepared to supervise graduate theses on linguistic subjects.

In co-operation with the Faculty of Graduate Studies and Research, the department publishes the papers of the annual Algonquin Conference.

Graduate Courses*

- Linguistics 29.590F1, W1, S1

Native Languages of Canada

A tutorial to study the descriptive, historical, and anthropological aspects of selected native languages of Canada, among them Cree, Iroquois, and Inuit.

Prerequisite: Honours courses in linguistics or permission of the department.

- Linguistics 29.591F1, W1, S1

Sociolinguistic Aspects of Bilingualism

A tutorial to study the linguistic aspects of French-English bilingualism, including sociolinguistic and psycholinguistic factors.

Prerequisite: Honours courses in linguistics or permission of the department.

- Linguistics 29.592F1, W1, S1

Tutorial in Applied Language Studies

A one-term tutorial to study applications of linguistics in such areas as first-language education and second-language teaching.

- Linguistics 29.598T2

Directed Studies in Applied Linguistics

A two-term tutorial to study applications of linguistics in such areas as first-language education and second-language teaching.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of Music

The Department

Chairman of the Department: Bryan Gillingham

The Department of Music offers courses at the graduate level in the history of Canadian music and related fields, in co-operation with the Institute of Canadian Studies. Full use will be made of the resources of the National Library, the Public Archives, and the National Museum of Man.

Dr. Elaine Keillor is lecturer in Canadian music with Dr. Helmut Kallmann (Chief Music Librarian, National Library) as Adjunct Professor.

Graduate Courses*

- Music 30.510T2

History of Canadian Music I

Selected aspects of Canadian music from 1600 to the present; liturgical music; social and economic conditions of Canadian musical life; regional studies; individual composers.

Prerequisite: Permission of the department and the Institute of Canadian Studies.

- Music 30.511F1

History of Canadian Music II

Anglo- and Franco-folk music traditions in Canada, past and present.

Prerequisite: Permission of the department and the Institute of Canadian Studies.

- Music 30.512W1

History of Canadian Music III

The music of various ethnic minorities in Canada with special emphasis on Inuit and Indian traditions.

Prerequisite: Permission of the department and the Institute of Canadian Studies.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

The Department

Chairman of the Department: Andrew Jeffrey
Departmental Supervisor of Graduate Studies:
D.E.Dubrule

The Department of Philosophy offers programs of study leading to the degree of Master of Arts.

Qualifying-Year Program

Applicants who do not hold an honours degree (or the equivalent) will be required to register in a qualifying-year program before proceeding to the master's program.

The regulations governing the qualifying year are outlined in the general section of this calendar.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an honours B.A. degree (or the equivalent) in Philosophy, with at least high second-class standing.

Qualifying-year and M.A. applicants from an institution other than Carleton University must submit two papers.

Program Requirements

The specific program requirements for master's candidates are the following:

- Philosophy 32.545, the departmental seminar
- A thesis equivalent to two full-course credits, which must be defended at an oral examination; or a research essay equivalent to one full-course credit
- Four half-course credits (or six in the case of students following the research essay option) in at least three of the following study areas: studies in the history of philosophy; studies in the work of an individual philosopher; studies in logic, epistemology, or metaphysics; studies in selected problems in philosophy.

In exceptional cases, a maximum of one full course (or the equivalent) may be selected from those offered at the 400 level, or in a related field, or at another university.

Selection of Courses

The department normally offers each year six 400-level undergraduate half-courses, which are open to

students in the qualifying year and, with permission, to students in the M.A. program. For courses offered in 1985-86, please consult the undergraduate calendar.

Graduate Courses*

The following graduate courses are open to students in the M.A. program and, with permission, to students in the qualifying-year program. Five two-hour tutorial sessions will be required in each half-course.

- Philosophy 32.504F1
Tutorial in the History of Philosophy I
Detailed study of a period or issue in the history of philosophy.
- Philosophy 32.505W1
Tutorial in the History of Philosophy II
Detailed study of a period or issue in the history of philosophy.
- Philosophy 32.510F1
Advanced Problems in Legal Philosophy
Studies in legal theories and analyses of law advanced by Hart, Dworkin and others, and legal concepts: for example, principles, rights, duties, liability, etc. Precise course content will vary from year to year and will be announced at the beginning of the term.
Prerequisite: Philosophy 32.350 or Philosophy 32.311 and 32.312 (Law 51.311 and 51.312), or permission of the relevant department.
(Also offered as Law 51.510)
P.J. Fitzgerald and R.R.A. Marlin.
- Philosophy 32.514F1
Tutorial in the Work of an Individual Philosopher I
A critical and systematic study of the work of an individual philosopher.
- Philosophy 32.515W1
Tutorial in the Work of an Individual Philosopher II
A critical and systematic study of the work of an individual philosopher.
- Philosophy 32.524F1
Tutorial in Logic, Epistemology, or Metaphysics I
An attempt to find a solution to a specific problem in logic, epistemology, or metaphysics.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Philosophy 32.525W1

Tutorial in Logic, Epistemology, or Metaphysics II
An attempt to find a solution to a specific problem in logic, epistemology, or metaphysics.

- Philosophy 32.534F1

Tutorial in Selected Problems of Philosophy I
An attempt to find a solution to a specific problem in some area other than logic, epistemology, or metaphysics.

- Philosophy 32.535W1

Tutorial in Selected Problems of Philosophy II
An attempt to find a solution to a specific problem in some area other than logic, epistemology, or metaphysics.

- Philosophy 32.545T2

Departmental Seminar
Research papers to be given by faculty members and students.

- Philosophy 32.562W1

Ethical and Cultural Dimensions in Development Studies
Exploration of concepts of value, rights, duties, law, and obligation in relation to global development issues. Comparative analysis of major ideological and ethical foundations of regional cultures, and the problems for cross-cultural and transnational relations.

- Philosophy 32.598F2, W2, S2

Research Essay

- Philosophy 32.599F4, W4, S4

M.A. Thesis

The Department

Chairman of the Department: L.T. Librande
Departmental Supervisor of Graduate Studies:
To be announced

The Department of Religion offers programs of study leading to the degree of Master of Arts.

Master of Arts

Admission Requirements

The minimum requirement for admission to the master's program is an honours bachelor's degree in religion (or the equivalent) with at least high second-class standing.

Applicants who do not hold an honours degree in religion (or the equivalent) will be required to register in a qualifying-year program before proceeding to the master's program.

The regulations governing the qualifying year are outlined in the general section of this calendar.

Program Requirements

The student will choose a program of study concentrating on one of the following major areas: comparative religion, with special emphasis on one of the major traditions; biblical and ancient near eastern studies; and modern religious thought and culture. Candidates must follow either a thesis or non-thesis program. The specific requirements are as follows:

Thesis Program

- Seminars equivalent to one full course in major area
- Seminars equivalent to one full course, selected from one or both of the other areas
- Tutorial in major area for one-course credit
- Thesis (equivalent to two full courses) on a topic in major area, which must be defended at an oral examination.

Non-Thesis Program

- Seminars equivalent to three full courses; of these, at least two half-course seminars must be from the major area, at least two from a second area, and at least one from the remaining area.
- Comprehensive reading course in major area
- One additional course in major area.

The student's program will be worked out in consultation with, and with the approval of, the department's supervisor of graduate studies and its

committee on graduate studies. The prescribed program will take into account the student's background and special interests, as well as the research interests and competence of the staff.

Language Requirements

The student will be required to acquire, or to demonstrate that he/she already has, a reading knowledge of whatever language is essential to his/her research.

Students are advised to consult the departmental handbook for further regulations.

Graduate Courses*

- Religion 34.511W1
Seminar in Comparative Religion
The Buddhist Path of Purification
A study of the Buddhist Path of Purification in the Theravada Buddhist text, the *Visuddhimagga* of Buddhaghosa which deals with the Buddhist philosophy and psychology as they are related to the practices of mindfulness (sata), concentration (samadhi) and insight (vipassana).
- Religion 34.512T2, S2
Tutorial in Comparative Religion
- Religion 34.513F1, W1, S1
Directed Studies in Comparative Religion
Seminar for additional study in this area.
- Religion 34.520F1
Seminar in Biblical and Ancient Near Eastern Studies: Jewish-Christian Relations in the First Two Centuries C.E.
A study of the origins of Christian anti-semitism in the context of the transformation of Christianity from a Jewish sect to an independent religion.
S.G. Wilson.
- Religion 34.522T2, S2
Tutorial in Biblical and Ancient Near Eastern Studies

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Religion 34.523F1, W1, S1

Directed Studies in Biblical and Ancient Near Eastern Studies

Seminar for additional study in this area.

- Religion 34.530F1

Seminar in Modern Religious Thought and Culture:

The Interconnection of Religion and Ethics

An inquiry into the connection between premises about the sacred persons, history, and nature implied or explicated in the doctrines and symbols of religious traditions, and the moral values and action-guides of those traditions.

A.R. Gualtieri.

- Religion 34.532T2, S2

Tutorial in Modern Religious Thought and Culture

- Religion 34.533F1, W1, S1

Directed Studies in Modern Religious Thought and Culture

Seminar for additional study in this area.

- Religion 34.590T2, S2

M.A. Comprehensive Reading

Not open to students pursuing a thesis program.

- Religion 34.599F4, W4, S4

M.A. Thesis

Courses Not Offered in 1985-86

34.510 Seminar in Comparative Religion

34.521 Seminar in Biblical and Ancient Near Eastern Studies

34.531 Seminar in Modern Religious Thought and Culture

The Department

Chairman of the Department: Ross Larson
Departmental Supervisor of Graduate Studies:
 C.A. Marsden

The Department of Spanish offers a master's program, with specialization in either Peninsular or Spanish-American literature, or a combination of both.

All requests for more information concerning the program should be addressed to the departmental supervisor of graduate studies. The department will supply reading lists for individual courses and for the general comprehensive examination, and a brochure containing details of particular requirements and other information related to Spanish studies at Carleton.

Master of Arts

Admission Requirements

The requirements for admission to the master's program are outlined in the general section of this calendar.

Program Requirements

The minimum program requirements for master's candidates are stated in the general section.

The master's program may be undertaken in one of the following optional patterns:

- Three full courses (or the equivalent, not including 38.595), and a thesis equivalent to two full courses
- Five full courses (or the equivalent, not including 38.595).

The department also requires all students to undertake general comprehensive examinations, and to complete a non-credit tutorial on bibliography and research methods.

In certain circumstances, students wishing to study aspects of Hispanic literature not specifically offered by the department may enrol in Spanish 38.590 or 38.591: Directed Studies, if a specialist in the desired field is available.

All courses taken by graduate students shall be chosen in consultation with the department. From time to time certain courses offered by other departments may be accepted as part of the master's program in Spanish, and special arrangements may occasionally be made to undertake part of the program at universities in Spanish-speaking countries.

Selection of Courses

The following senior undergraduate courses are open to students in the qualifying-year program and, with permission, to students in the M.A. program.

Spanish

- 38.402 Theories of Literature
- 38.415 Medieval Spanish Literature from the Origins through 1300
- 38.416 Medieval Spanish Literature, 1300-1500
- 38.420 Cervantes
- 38.430 Modern Spanish Novel
- 38.431 Contemporary Spanish Novel
- 38.435 Modern Spanish Drama
- 38.436 Contemporary Spanish Drama
- 38.440 Modern Spanish Poetry
- 38.441 Contemporary Spanish Poetry
- 38.460 Twentieth-Century Spanish-American Novel I
- 38.461 Twentieth-Century Spanish-American Novel II
- 38.470 Twentieth-Century Spanish-American Poetry I
- 38.471 Twentieth-Century Spanish-American Poetry II
- 38.490 Seminar on a Special Topic
- 38.491 Seminar on a Special Topic
- 38.492 Special Studies

Graduate Courses*

- Spanish 38.506F1
 History of the Spanish Language II
 Historical grammar of the Spanish language; synchronic and diachronic study of the phonetic, morphological, and syntactic structure of the Spanish language.
 José Jurado.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

● Spanish 38.520W1

Special Topic on Golden Age Literature

Topic for 1985-86: Góngora

Close textual reading of major and minor works of Góngora against a background of previous and current attitudes toward *culteranismo* and *conceptismo*.

C.A. Marsden.

● Spanish 38.525W1

Studies in Eighteenth-Century Literature

Topic for 1985-86: Eighteenth-Century Poetry

Critical study of the various poetic currents of the period with particular attention to the works of Torres Villarroel, N. Moratín, Samaniego, Iriarte, Iglesias, Meléndez Valdés, Arjona and Reinoso. José Jurado.

● Spanish 38.530F1

Problems of Modern Spanish Literature

Topic for 1985-86: Language and Genre in Alberti and Lorca

The specificity of literary language to a genre will be studied in works by Alberti and Lorca that have been adapted from poetry or narrative to the theatre Angel López-Fernández.

● Spanish 38.560W1

Aspects of Spanish-American Literature after 1888

Topic for 1985-86: Games and Play in Spanish-American Fiction

A study of the function of lexical and conceptual play, interior duplication of mythological and literary models, allegories, parodies, enigmas, doubles and other ludic devices in self-conscious Spanish-American narratives.

Ross Larson.

● Spanish 38.570F1

Special Problems in Spanish-American Literature

Topic for 1985-86: The Prose and Poetry of Nicolás Guillén

An analysis of the prose writings and the *poesía sintetizante* of Cuba's national poet. Special emphasis will be given to the ethnicity factor, to literary aesthetics and to the new phase of literary Americanism that Guillén's humanism and his writings on racism, culture and revolution represent.

R.L. Jackson.

● Spanish 38.590T2, S2

Directed Studies

● Spanish 38.591F1, W1, S1

Directed Studies

● Spanish 38.595F1, W1, S1

Directed Readings

Additional half-courses, designed in particular for students requiring special assistance in preparing for comprehensive examinations.

● Spanish 38.599F, W, S

M.A. Thesis

Courses Not Offered in 1985-86

38.505 History of the Spanish Language I

38.515 Aspects of Medieval Literature

38.550 Aspects of Spanish-American Literature before 1888

Departmental

Program

Descriptions

and

Details

of

Courses

Faculty of Engineering

Dean: J.S. Riordon

Programs of study are offered by the Faculty of Engineering leading to the degrees of Master of Engineering and Doctor of Philosophy in Aeronautical, Civil, Electrical, and Mechanical Engineering, to the degree of Master of Engineering in Materials Engineering and, in co-operation with the Faculty of Science, to the degree of Master of Science in Information and Systems Science.

The graduate programs in each of the engineering departments at Carleton University and the University of Ottawa are administered through joint institutes in three engineering disciplines. The Ottawa-Carleton Institute for Research and Graduate Studies in Electrical Engineering was established in 1983; and in Mechanical and Aeronautical Engineering, and in Civil Engineering in 1984. Each of these institutes combines the research strengths and resources of departments of engineering at Carleton and at the University of Ottawa, and provides a framework for interaction. The institutes are also concerned with applications for graduate programs and graduate course offerings. Programs leading to master's and Ph.D. degrees are available through the institutes in a wide range of sub-disciplines in each department.

The areas of current research, the research facilities available, and the graduate courses offered, are given in the following pages for the four departments of the faculty:

- Civil Engineering
- Electronics
- Mechanical and Aeronautical Engineering
- Systems and Computer Engineering

Both the master's and Ph.D. programs may be undertaken on a full-time or part-time basis.

General information on awards and financial assistance is given in that section of this calendar.

A limited number of students who are not degree candidates may be admitted to each graduate engineering course. Credit earned as a special student normally cannot be credited towards a graduate degree in engineering.

Computing Facilities

Computing facilities available to engineering students include the University's central Honeywell mainframes with time-sharing terminals. Also two VAX minicomputers, four SUN work-stations, and several Apollo engineering workstations with an FPS-164 attached processor reside in the engineering departments. Several other computers within the faculty are in use for data acquisition and specific research projects.

Special Arrangements

Research in an Outside Institution

A student may apply for permission to carry out his/her research, in part or whole, in an outside institution (for example, industrial, governmental, or university laboratory). Such an application, addressed to the dean of Graduate Studies and Research through the dean of Engineering, should:

- Include a detailed statement of the research proposal, of arrangements for supervision, and of the circumstances under which it is to be carried out
- Establish that the applicant will be able to pursue independent research
- State the facilities available for the research
- Include a proposed time schedule
- Be accompanied by a supporting letter from a responsible person in the outside institution giving approval of the proposal and accepting these regulations.

Part-time Thesis Research

A part-time research program may be permitted if the conditions for the "presence" of the student (outlined under faculty regulations) are satisfied. It is the responsibility of the research supervisor to define the fraction of full-time research engaged upon by the student so that this can appropriately be credited to his/her program and assessed for payment of tuition fees. Before permission to undertake research on a part-time basis can be granted, the student must submit in writing, to the dean of Graduate Studies and Research through the dean of Engineering, a statement of his/her proposed manner of working part-time, supported by a letter of approval from his/her employer.

Waiver of Thesis

A candidate for the master's degree who has, before admission, completed independent research or development projects of an adequate level of accomplishment, may apply to the chairman of the department concerned for a waiver of the thesis requirement. Such application must be made at the time of initial registration, and must be supported by copies of published reports describing the work. If the application is approved, the candidate must complete 10 half-courses or the equivalent, six of which must be graduate-level courses in engineering, to fulfil the requirement for the award of a degree without a thesis. A candidate who has been granted a waiver of the thesis requirement will be required to take an oral

examination on the subject of one of his/her published papers and topics related to his/her field of specialization.

Transfer of Credit

Normally credit for one full graduate course completed at another university may be accepted in partial fulfilment of degree requirements, provided that the course is appropriate to the candidate's program at Carleton. Under special circumstances a second full course may be allowed. Refer to the general section of this calendar for details of the rules governing transfer of credit.

Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance and demonstrates high promise for advanced research during the full-time master's program at Carleton may, subject to meeting the requirements below, be permitted to transfer into the Ph.D. program without receiving the master's degree. Such a student must complete the course requirements and thesis registration requirements of the master's program, but is exempted from submission of the thesis.

A student wishing to transfer should apply to the chairman of his/her department. If the department and the Faculty of Graduate Studies and Research approve the application, the candidate will be required to take the comprehensive examination for the Ph.D. The requirements for the comprehensive examination will then include the submission of a report on research to date, and a research proposal for the Ph.D.

After successfully passing the comprehensive examination, the student will be admitted to the Ph.D. program with normal program requirements (but with the comprehensive examination to his/her credit). If unsuccessful, he/she will remain in the master's program and be required to submit the thesis in the usual way.

Faculty Regulations

Graduate students in the Faculty of Engineering are governed by the section of this calendar entitled General Regulations, and by the regulations stated in this section.

All graduate students in the Faculty of Engineering must obtain satisfactory grades in their course work, must make satisfactory progress in their research if a thesis is included in their program, and must satisfy the following criteria of activity or "presence" in the program:

- Maintain a close working relationship with their research supervisor.
- Attend the courses for which they are registered.
- Submit written reports and present seminars as required by their supervisor.
- Attend departmental seminars held regularly to discuss current research and related topics. Each student is required from time to time to present a seminar on his/her research; part-time students who are not actively engaged in research are exempt from the seminar requirement.
- Be readily available on an informal basis.

Thesis Regulations

The thesis must represent the result of the candidate's independent research or development work, undertaken after admission to graduate studies at Carleton University. Experimental or theoretical results previously published by the candidate may be used only as introductory or background material for the thesis. A candidate may be permitted to carry on thesis research work off campus, provided that the work is approved in advance, and arrangements have been made for supervision of thesis research activities by a faculty member of Carleton University. A part-time student may use the Faculty of Engineering laboratory facilities for on-campus thesis research and development activities.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of the thesis and related fields.

Registration and Course Selection

- Undergraduate engineering courses may not normally be taken for credit.
- All students require departmental approval for their program of studies, for course registration, and for any changes to their status or program.
- Each full-time student is required, in any fall or winter term in which he/she has outstanding program requirements of three or more half-courses, to register for credit in at least three half-courses. After the last day for withdrawal from courses in each such term, the student must remain registered in at least three half-courses.
- For part-time students, the department will arrange the appropriate course loading and selection.

Master of Engineering

Admission Requirements

Applicants are admitted under the general regulations specified in this calendar, but, in addition, are

required to have strong undergraduate preparation in the appropriate engineering disciplines, computer programming, mathematics, and physics.

Program Requirements

Two alternatives are available for full-time students studying towards the degree of Master of Engineering, one involving a thesis plus course work, the other involving course work only. The choice of these alternatives must be arranged and approved at the time of admission into the program. Students are encouraged to take at least one half-course outside of their department.

M.Eng. by Thesis

- A thesis based on the student's research
- A minimum of six half-courses in engineering or a related discipline. The number of courses required by each department is specified in its section of this calendar.

M.Eng. by Course Work

Specific program requirements are detailed in the departmental sections of this calendar.

Doctor of Philosophy

Admission Requirements

For admission to the Ph.D. program, an applicant must normally hold a master's degree in engineering (or its equivalent) and, by his/her previous program of study and scholastic record, demonstrate a capacity for advanced study and research. Experience gained while working in an engineering or research environment will be taken into account when assessing an application. The applicant must specify his/her intended field of research.

Program Requirements

The specific program requirements for the Ph.D. degree are the following:

- A minimum of two calendar years of full-time study (or the equivalent)
- Course requirements as established on admission, but not less than six half-courses, or equivalent, in total (except in the Departments of Systems and Computer Engineering and of Electronics); these requirements must include at least four graduate-level half-courses in engineering and at least one full course in an appropriate discipline outside the Faculty of Engineering. (For information on admission and program requirements for the Departments of Systems and Computer Engineering and of Electronics, please refer to page 112.)

- Substantial research
- A thesis on the research.

Advisory Committee

An advisory committee with at least three members will be appointed by the department soon after a student's first registration. It has the responsibility of ensuring that conditions for the pursuit and completion of the student's program are fulfilled, and it reviews his/her progress at least once a year.

Comprehensive Examination

The comprehensive examination is held approximately one year after initial registration in the program in the case of full-time students, and at an equivalent time in the case of part-time students. The purpose of the examination is threefold:

- To assess the student's comprehensive knowledge of his/her field of study
- To assess the preparedness and capability of the student for doctoral research
- To judge the suitability of the research topic for a doctoral thesis.

The student is required to present his/her research proposal, and to be subjected to oral and written examination in appropriate fields of study. He/she will be informed by the advisory committee of the specific requirements of the examination. Having successfully completed the comprehensive examination, the student becomes a doctoral candidate.

Department of Civil Engineering

The Department

Chairman of the Department: A.P.S. Selvadurai
Departmental Supervisor of Graduate Studies:
J.J. Salinas

The Department of Civil Engineering offers programs of study and research leading to the Master of Engineering and Ph.D. degrees in Civil Engineering. These degrees are offered through the Ottawa-Carleton Institute for Graduate Studies and Research in Civil Engineering which is jointly administered by the Department of Civil Engineering at Carleton University, and the Department of Civil Engineering at the University of Ottawa. For further information, including admission and program requirements, see page 88.

The department conducts research and has developed graduate programs in the following areas:

- **Structural Mechanics**

The graduate program in structural mechanics concentrates on analytical and design studies in the following fields: computer applications in structural analysis, behaviour of steel, concrete and composite structures; structural dynamics, seismic analysis; structural optimization; finite element analysis. Graduate research in structural mechanics is currently directed to the following areas:

- *Computer Applications in Structural Design*

Computer-based systems for analysis, design, and graphics processing; structural analysis of building frames; pre- and post-processing of frame analysis and finite element analysis packages in structural applications.

- *Seismic Analysis and Design*

Seismic response of set-back and other irregular buildings; computer analyses of linear and non-linear structural response; design of buildings for seismic forces

- *Continuum Mechanics*

Linear and nonlinear problems in elasticity; analysis of contact problems in elasticity, plasticity, and viscoelasticity; mechanics of composite materials; fracture processes in geological materials; finite deformations of rubberlike materials

- **Building Design and Construction**

The graduate program in building design and construction emphasizes the following fields: masonry behaviour and design, timber structures; structural systems and design optimization; inte-

grated treatment of structural, mechanical, and electrical building requirements; construction economics, project planning. Graduate research in building design and construction is currently directed to the following areas:

- *Computer-Aided Building Design*

Development of applications software for design of building structural components and systems

- *Masonry Behaviour and Design*

Shear strength of reinforced masonry beams; masonry deformations; floor systems for masonry structures; winter masonry construction

- *Timber Structures*

Analysis, design and performance evaluation of wood-structured systems and components; structural reliability

- **Transportation Planning and Technology**

The graduate program in transportation planning and technology deals with problems of policy, planning, economics, design, and operations in all modes of transportation. In the area of transportation planning, the focus is on the design of transport systems, including terminals, modelling and simulation, urban and regional studies, traffic engineering, and geometric design. In the transportation technology area, programs deal with technology of vehicles and facilities, acoustics and noise, materials and pavement design. Graduate research in transportation is currently focused on the following areas:

- *Transport Policy*

Assessment and impact analysis of national, regional, and urban transportation policies

- *Planning and Design Methodology*

Development and application of models for optimization of transport supply, transportation system management

- *Travel and Traffic Analyses*

Behavioural theories of passenger travel, goods movement, empirical traffic studies

- *Transportation Terminals*

Airport planning, air terminal design; bus, rail, subway terminal design, layout methods, pedestrian traffic

- *Transportation Technology Development and Assessment*

Modernization of passenger and freight rail services; soil properties; pavement design, multi-layered systems, highway design, energy

● Geotechnical Engineering

The graduate program in geotechnical engineering places an emphasis on both theoretical and applied problems related to soil and rock mechanics and foundation engineering. These generally include the study of mechanical properties of soil and rock materials, stability of natural slopes and earth embankments, soil-foundation-structure interaction, and problems in foundation design and geomechanics. Broader programs in geotechnical engineering may be arranged by making use of courses offered in the Department of Geography at Carleton University and in the Department of Civil Engineering at the University of Ottawa. Graduate research in geotechnical engineering is primarily directed towards the following areas:

Soil-Foundation Interaction

Elastic and consolidation effects of soil-foundation interaction; soil-frame interaction; contact stress measurement; performance of rigid and flexible foundations; buried pipelines

Bearing Capacity and Settlement

Problems related to design of bridge abutments and footings located on sloped granular fill, experimental and field studies

In-Situ Testing of Soils

The use of devices such as the pressure meter, the screw plate test, the borehole shear device, and borehole dilatometer in the assessment of geotechnical properties of soils

Mechanical Behaviour

Development of constitutive relations for soils and rock masses with yield and creep characteristics; applications to foundation engineering

Mechanics of Geological Structures

Large strain phenomena; buckling of strata; applications to underground storage structures; hydraulic fracture of oil- and gas-bearing geological media

Performance of Anchors

Theoretical and experimental analysis of deep and shallow anchors in soil, rock, and concrete; group action; creep effects; prestress loss

Nuclear Waste Disposal

Theoretical modelling of rockmass-buffer-canister interaction during moisture migration; non-homogeneous swelling of buffer materials; swelling pressures in buffer systems

Laboratory facilities include a 400,000 lb. universal testing machine with auxiliary equipment for load and strain control; an electrotesting machine, specialized equipment for torsion and impact studies; advanced equipment for electric resistance

strain gauge work; and a wide selection of other loading, measuring, and recording equipment for testing structural materials and components. The concrete laboratory has facilities for the casting, curing, and testing of reinforced concrete members. Laboratory facilities in geotechnical engineering include both large scale and conventional tri-axial testing, consolidation testing, pore water pressure measurements, and model studies of contact stress measurements. The soil dynamics and highway materials laboratories provide facilities for studies of the physical properties of soil, stabilized soil, aggregate and bituminous mixtures.

Computer-related equipment within the department comprises several minicomputers; five terminals, including two storage scope display terminals; and a digitizing table. This equipment is interfaced to the Honeywell Level 66 computer in the University computer centre. A library of computer programs for structural engineering is a significant resource for advanced study and research.

Graduate Courses*

● Engineering 82.511F1

Introductory Elasticity

Stresses and strains in a continuum; transformations, invariants; equations of motion; constitutive relations, generalized Hooke's Law, bounds for elastic constants: strain energy, superposition, uniqueness; formulation of plane stress and plane strain problems in rectangular Cartesian and curvilinear co-ordinates; Airy-Mitchell stress functions and Fourier solutions, application of classical solutions to problems of engineering interest.

A.P.S. Selvadurai.

● Engineering 82.512W1

Advanced Elasticity

Continuation of topics introduced in Engineering 82.511. Complex variable solutions. Torsional and thermal stresses; axially symmetric three-dimensional problems, Love's strain potential, Boussinesq-Galerkin stress functions; problems related to infinite and semi-infinite domains. Intro-

*F,W,S indicates term of offering.

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duction to numerical methods of stress analysis, comparison of solutions.

Prerequisite: Engineering 82.511 or permission of the department.

A.P.S. Selvadurai.

● Engineering 82.513W1

Finite Element Methods in Stress Analysis

Finite element theory and numerical methods.

Constant strain triangles. Linear strain triangles.

Reinforced triangles. Axi-symmetric shells. Axi-

symmetric solids. Plates in bending. Throughout

the course, application to engineering problems is emphasized.

G.A. Hartley.

● Engineering 82.514W1

Earthquake Analysis and Design of Structures

Structural dynamics, single- and multi-degree-of-freedom systems, formulation of equations of motion, free and forced vibrations, normal mode

analysis. Seismological background, selection of

design earthquake. Deterministic analysis of earthquake response, linear and nonlinear analysis,

influence of foundation medium. Design considerations and code requirements, equivalent static load

method, response spectrum approach.

J.L. Humar.

● Engineering 82.515S1

Advanced Finite Element Analysis in Structural

Mechanics

Fundamentals of calculus of variations; variational

and Galerkin formulations: assumed displacement,

assumed stress and hybrid elements; isoparametric

elements and numerical integration; plate bending:

convergence, completeness and conformity, patch

test, Kirchhoff and Mindlin plate theories, non-

linear elasticity and plasticity; cracking and

nonlinearities in reinforced concrete structures;

incremental and iterative schemes, geometric non-

linearity: small strain — large displacement, large

strain — large displacement, Eulerian and

Lagrangian formulations; finite elements in dynam-

ics; finite element programming.

Prerequisite: Engineering 82.513 or permission of the department.

A.G. Razaqpur.

● Engineering 82.523W1

Theory of Structural Stability

Elastic and inelastic behaviour of beam-columns;

elastic and inelastic buckling of frames; application

of energy methods to buckling problems; lateral-

torsional buckling of columns and beams; buckling

of plates; local buckling of columns and beams.

Prerequisite: Engineering 82.525 or equivalent.

● Engineering 82.524F1

Behaviour of Steel Structures

Steel as a structural material; bolted and welded

connections; brittle fracture and fatigue; members

subjected to combined bending and compression,

and to twist and local buckling; structural stability

of frames.

C.D. Nixon.

● Engineering 82.525F1

Analysis of Elastic Structures

Application of matrices to structural analysis; force

and displacement method of analysis for framed

elastic planar and space structures; introduction to

structural dynamics.

J.L. Humar.

● Engineering 82.526W1

Prestressed Concrete

Outline and scope of design concepts. Flexural

behaviour, shear, bond, losses. End block design.

Post-tensioned slabs. Some considerations on

bridge design. Pavements. Design optimization.

Prerequisite: Engineering 82.528 or permission of the department.

J.J. Salinas.

● Engineering 82.527W1

Advanced Structural Design

A number of topics, such as the evolution of a

structure, structural form, aesthetics, progressive

collapse, and design in various structural materials,

are treated by members of the department and

outside experts.

John Adjeleian and G.T. Suter.

● Engineering 82.528F1

Advanced Reinforced Concrete

The research background, development, and limita-

tions in current building code provisions for

reinforced concrete; yield line theory of slabs;

safety and limit states design; computer design of

concrete structures.

C.M. Allen.

● Engineering 82.529S1

Case Studies in Geotechnical Engineering

The critical study of case histories relating to

current procedures of design and construction in

geotechnical engineering. The importance of instru-

mentation and monitoring field behaviour will be

stressed. In-situ testing.

G.C. McRostie.

● Engineering 82.530F1

Advanced Soil Mechanics I

Effective stress, pore pressure parameters, satu-

rated and partially saturated soils; seepage;

permeability tensor, solutions of the Laplace equation; elastic equilibrium; anisotropy, non-homogeneity, consolidation theories; shear strength of cohesive and cohesionless soils.

K.T. Law.

● Engineering 82.531W1

Advanced Soil Mechanics II

Plasticity in soil mechanics; failure and yield criteria, plastic equilibrium, upper and lower bound solutions, uniqueness theorems; statically and kinematically admissible states; stability analysis of cohesive and cohesionless soils.

A.P.S. Selvadurai.

● Engineering 82.533F1

Pavements and Materials

An analysis of the interaction of materials, traffic, and climate in the planning, design construction, evaluation, maintenance, and rehabilitation of highway and airport pavements.

A.O.A. Halim.

● Engineering 82.534F1

Intercity Transportation, Planning and Management

Current modal and intermodal issues, including energy. Framework and process of intercity transportation planning and management. Recent trends and system development. Passenger and freight demand and service characteristics. Future prospects and possibilities.

A.M. Khan.

● Engineering 82.535F1

Traffic Engineering

Introduction to principles of traffic engineering. Basic characteristics of drivers, vehicles, and traffic. Volume, speed, and delay studies. Traffic stream characteristics and queueing theory. Capacity analysis of roads and intersections. Safety.

J.P. Braaksma.

● Engineering 82.536W1

Highway Materials

Materials characterization and strength evaluation of soils, stabilized soils, aggregates, and asphalt concrete. Effects of low temperatures and frost on materials behaviour.

A.O.A. Halim.

● Engineering 82.537W1

Urban Transportation Planning and Management

Urban transportation systems planning and management. Urban development models — an introduction. Urban transportation policy.

W.F. Johnson.

● Engineering 82.538W1

Geometric Design

Basic highway geometric design concepts. Vertical

and horizontal alignment. Cross-sections. Interchange forms and design. Adaptability and spacing of interchanges. Design of operational flexibility; operational uniformity, and route continuity on freeways.

A.O.A. Halim.

● Engineering 82.539W1

Intercity Transportation Supply

Advanced treatment of intercity transportation planning and management concepts and techniques: transport supply issues, capacity and costs, evaluation of system improvements and extensions, transportation and development, policy impact analysis.

A.M. Khan.

● Engineering 82.541W1

Transportation Economics and Policy

Transportation, economic analysis framework. Transport industry output. Carrier operations. Issues of resource utilization, measurement, economics of supply of infrastructure, pricing; subsidies, externalities. Transport policy in Canada.

George Hariton.

● Engineering 82.542F1

Transportation Terminals

Framework for passenger terminal planning and design. Theory: the transfer function and network modelling; pedestrian flow characteristics; capacity of corridors, stairs, escalators, and elevators; layout planning. Practical applications: air, rail, metro, bus, ferry, and multi-modal terminals.

J.P. Braaksma.

● Engineering 82.543F1

Airport Planning

Framework for airport planning and design. Aircraft characteristics; demand forecasting; airport site selection; noise, airside capacity; geometric design; the passenger terminal complex; cargo area; general aviation; ground transportation; land use planning.

J.P. Braaksma.

● Engineering 82.550F1

Earth Retaining Structures

Approaches to the theoretical and semi-empirical analysis of earth retaining structures. Review of the earth pressure theories. Analysis and design methods for rigid and flexible retaining walls, braced excavations, and tunnels. Instrumentation and performance studies.

G.E. Bauer.

● Engineering 82.551W1

Foundation Engineering

Review of methods of estimating compression and

shear strength of soils. Bearing capacity of shallow and deep foundations. Foundations in slopes. Pile groups. Use of in-situ testing for design purposes. Instrumentation and performance of prototype structures. Design codes.

G.E. Bauer.

● Engineering 82.552W1

In-Situ Methods in Geomechanics

Scope of a subsurface exploration program. Techniques of soil and rock sampling. Geophysical methods. Mechanical and hydraulic properties of soil and rock. In-situ determination of strength, deformability and permeability of soils and rocks. Critical evaluation of vane, pressuremeter, screw plate, flat dilatometer, borehole shear and plate load tests. Pumping, recharge and packer tests. Permeability of jointed rocks. Rock testing techniques, borehole dilatometer, flat jack, cable jacking tests. Properties of rock joints. In-situ stress measurements.

A.P.S. Selvadurai.

● Engineering 82.553S1

Numerical Methods in Geomechanics

Critical review of advanced theories of soil and rock behaviour. Linear elasticity, non-homogeneity and anisotropy. Plasticity models; Generalized Mohr-Coulomb and Drucker-Prager failure criteria. Critical state and cap models. Dilatancy effects. Associated and non-associated flow rules. Hardening rules, hypoelasticity. Soil consolidation, viscoelasticity and creep behaviour of rock masses. Rock joints. Finite element formulation of nonlinear problems. Iterative schemes; tangent stiffness, initial stress and initial strain techniques, mixed methods. Time marching schemes. Solution of typical boundary value problems in geomechanics with the aid of existing research class finite element codes.

Prerequisites: Engineering 82.511, 82.513, or permission of the department.

A.P.S. Selvadurai.

● Engineering 82.554S1

Seepage and Waterflow through Soils

Surface-subsurface water relations. Steady flow. Flownet techniques. Numerical techniques. Seepage analogy models. Anisotropic and layered soils. Water retaining structures. Safety against erosion and piping. Filter design. Steady and non-steady flow towards wells. Multiple well systems. Subsidence due to ground water pumping.

G.E. Bauer.

● Engineering 82.560S1

Project Management

Introduction to managing the development, design,

and construction of buildings. Examination of project management for the total development process, including interrelationships among owners, developers, financing sources, designers, contractors, and users; role and tasks of the project manager; setting of project objectives; feasibility analyses; budgets and financing; government regulations; environmental and social constraints, control of cost, time, and content quality and process; human factors.

William Dawson.

● Engineering 82.563S1

Computer-Aided Design of Building Structures

Relevant aspects of computer systems, information handling, auxiliary storage; design methods, computerized design systems; computer graphics; application of structural theory; examination of a selected series of structural engineering programs and programming systems.

E.W. Wright.

● Engineering 82.570F1, W1, S1

Special Topics in Building Design and Construction

Courses in special topics related to building design and construction, not covered by other graduate courses; details will be available some months prior to registration.

Topics for Spring 1986

● Engineered Masonry Behaviour and Design

Properties of masonry materials and assemblages. Behaviour and design of walls, columns and lintels. Treatment of specialized design and construction topics. Design of lowrise and highrise structures. Discussion of masonry problems. Emphasis throughout the course is placed on a practice-oriented approach.

G.T. Suter.

● Advanced Methods in Computer-Aided Design
Representation and processing of design constraints (such as building codes and other design rules); decision tables; constraint satisfaction. Automatic integrity and consistency maintenance of design databases; integrated CAD systems. Introduction to techniques from Artificial Intelligence. LISP Programming.

N.M. Holtz.

● Statistics, Probabilities and Decision-Making
Applications in Civil Engineering

Review of basic concepts in statistics and the Theory of Probabilities. Bayes' Theorem. Probability distributions. Moments. Parameter Estimation. Goodness of fit. Regression and cor-

relation. OC curves. Monte Carlo simulation. Probability-based design criteria. Systems reliability. Limit States Design. Selected applications in transportation, geomechanics and structures. Emphasis will be given to problem solving. Use of existing computer software. J.J. Salinas.

- Engineering 82.572F1, W1, S1
Special Topics in Geotechnical Engineering
Courses in special topics in geotechnical engineering, not covered by other graduate courses; details will be available some months prior to registration.

Topic for Spring 1986

- Analysis of Embankments and Slopes
Stability of embankments of soft clays; stress-strain analysis; anisotropy; strain rate effect; short and long-term settlement; methods of slope stability analysis; progressive failure; use of stability charts; slope analysis for residual and unsaturated soils. K.T. Law.

- Engineering 82.574F1, W1, S1
Special Topics in Transportation Planning and Technology
Courses in special topics in transportation engineering, not covered by other graduate courses; details will be available some months prior to registration.

Topic for Fall 1985

- Engineering Management
Engineering management principles, including Program and Project organization, personnel management, major management systems, project management, legal aspects of management, communication problems, politics and management, management of the engineering competition and union-management problems. G.Y. Sebastyan.

- Engineering 82.590F2, W2, S2
Civil Engineering Project
Students enrolled in the M.Eng. program by course work will conduct an engineering study, analysis, or design project under the general supervision of a member of the department.

- Engineering 82.596F1, W1, S1
Directed Studies

- Engineering 82.599F4, W4, S4
M.Eng. Thesis

- Engineering 82.699F, W, S
Ph.D. Thesis

Other Courses of Particular Interest

Mechanical and Aeronautical Engineering

- 88.514 Ground Transportation Systems and Vehicles
- 88.517 Experimental Stress Analysis
- 88.521 Methods of Energy Conversion
- 88.550 Advanced Vibration Analysis
- 88.561 Design Theory and Practice
- 88.562 Failure Prevention
- 88.568 Deformation of Materials

Systems and Computer Engineering

- 94.501 Simulation and Modelling

Geography

- 45.415 Slope Development: Forms, Processes and Stability
- 45.417 Glacial Geomorphology
- 45.533 Periglacial Geomorphology
- 45.534 Aspects of Clay Mineralogy and Soil Chemistry
- 45.579 Research and Development in Outdoor Recreational Geography

Public Administration

- 50.510 Management Accounting
- 50.511 Financial Management

Ottawa-Carleton Institute for Graduate Studies and Research in Civil Engineering

The Institute

Director of the Institute: G.E. Bauer

Associate Director of the Institute: S.S.F. Ng

Established in 1984, the institute combines the research strengths and resources of the Departments of Civil Engineering at Carleton University and the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the institute in a wide range of fields of civil engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research. Requests for information and applications for admission may be sent to the director of the institute.

Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Civil Engineering at Carleton University and (O) for the Department of Civil Engineering at the University of Ottawa.

Kazimierz Adamowski, *Hydrology, Stochastic and Statistical Analyses* (O)

John Adjeleian, *Structures, Building Design and Construction* (C)

M.C. Allen, *Structures, Building Design and Construction* (C)

G.E. Bauer, *Foundation Engineering, Soil Mechanics, In-Situ Testing* (C)

Care Berwanger, *Concrete, Concrete Composite Construction* (O)

W.H. Bowes, *Structures, Finite Element Analysis* (C)

J.P. Braaksma, *Transportation, Airport Planning, Traffic Engineering* (C)

M.S. Cheung, *Finite Elements Analysis, Bridge Engineering* (O)

R.L. Droste, *Environmental Engineering, Water and Wastewater Treatment* (O)

B.H. Fellenius, *Geotechnical Engineering, Deep Foundations* (O)

N.J. Gardner, *Structures, Reinforced Concrete, Earthquake Engineering* (O)

V. Garga, *Geotechnical Engineering, Dams, Harbours, Heavy Foundations* (O)

A.O.A. Halim, *Transportation, Pavement and Materials, Geometric Design* (C)

G.A. Hartley, *Structural Analysis, Finite Elements, Building Frame Analysis* (C)

N.M. Holtz, *Computer-aided Structural Engineering* (C)

J.L. Humar, *Structures, Earthquake Engineering, Computer-aided Design* (C)

A.M. Khan, *Transportation, Systems Planning, Engineering and Management* (C)

K.T. Law, *Geotechnical Engineering, Embankments, In-Situ Testing* (C)

S.S.F. Ng, *Structures, Numerical Methods, Dynamic Behaviour* (O)

A.G. Razaqpur, *Structures, Concrete, Numerical Methods* (C)

J.J. Salinas, *Building Structures, Wood Engineering* (C)

E.J. Schiller, *Environmental Engineering, Water Supply and Irrigation* (O)

G.Y. Sebestyan, *Transportation, Engineering Management* (C)

A.P.S. Selvadurai, *Geotechnical Engineering, Continuum Mechanics, Applied Mathematics* (C)

G.T. Suter, *Structural Engineering, Masonry Structures* (C)

Hiroshi Tanaka, *Structures, Wind Engineering* (O)

R.D. Townsend, *Water Resource Engineering, Applied Hydraulics, River Engineering* (O)

R.G. Warnock, *Water Resource Engineering, Stream Flow, Sedimentary Transport* (O)

P.E. Wisner, *Water Resource Engineering, Urban Hydrology, Environmental Impact Assessment* (O)

E.W. Wright, *Structures, Computer-aided Design* (C)

Master's Degree

Admission Requirements

The normal requirement for admission to the master's program is a bachelor's degree with at least high second-class standing in civil engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. The requirements for the master's degree by thesis are:

- Equivalent of 18 course credits
- Thesis
- Participation in the Civil Engineering seminar series
- Successful oral defence of the thesis.

The requirements for the master's degree by course work are: 36 course credits, of which a minimum of 24 will be course credits and a minimum of 6 will be project credits.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree with thesis in civil engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term.

- A minimum of 18 course credits
- Participation in the Civil Engineering seminar series
- Successful completion of written and oral comprehensive examinations in subject areas determined by the student's advisory committee
- Successful completion of a thesis proposal examination
- Thesis
- Successful oral defence of the thesis. The examination board for all theses will include an external examiner, and when possible, professors from both departments
- Subject to approval of his/her advisory committee, a Ph.D. student may take, or be required to take, courses in other disciplines.

Students who have been permitted to transfer into the Ph.D. program from a master's program without having completed the master's degree, will require 36 course credits for the Ph.D. degree which include transfer of credits from the incomplete master's program.

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or the advisory committee. Graduate courses are listed below, grouped by subject area. Course descriptions may be found in the departmental section of the calendar concerned. All courses are of one term duration. The codes given in parenthesis are those used by the University of Ottawa. Courses beginning with "82" are offered at Carleton University and those beginning with "83" are offered at the University of Ottawa. Not all courses listed are necessarily given during one academic year.

Geotechnical and Soils

82.529 (CVG 7100)	Case Studies in Geotechnical Engineering
82.530 (CVG 7101)	Advanced Soil Mechanics I
82.531 (CVG 7102)	Advanced Soil Mechanics II
82.533 (CVG 7103)	Pavements and Materials
82.550 (CVG 7104)	Earth Retaining Structures
82.551 (CVG 7105)	Foundation Engineering
82.552 (CVG 7106)	In-Situ Methods in Geomechanics
82.553 (CVG 7107)	Numerical Methods in Geomechanics
82.554 (CVG 7108)	Seepage and Water Flow Through Soils
82.572 (CVG 7109)	Special Topics in Geotechnical Engineering: Analysis of Embankments and Slopes
83.500 (CVG 5100)	Deep Foundations
83.501 (CVG 5101)	Advanced Rock Mechanics
83.502 (CVG 5102)	Theoretical Soil Mechanics
83.503 (CVG 5103)	Dam Engineering
83.504 (CVG 5104)	Soil Testing and Properties
83.505 (CVG 5105)	Slope Stability
83.506 (CVG 5106)	Site Improvements
83.507 (CVG 5107)	Engineering Aspects of Surficial Soils
83.508 (CVG 5109)	Rock Mechanics Applications
83.509 (CVG 5300)	Geotechnical Engineering in Cold Regions
83.510 (CVG 5302)	Waterfront Construction
83.511 (CVG 5349)	Mining Geotechnics

Structures and Construction Management

82.511 (CVG 7120)	Introductory Elasticity
82.512 (CVG 7121)	Advanced Elasticity
82.513 (CVG 7122)	Finite Element Methods in Stress Analysis
82.514 (CVG 7123)	Earthquake Analysis and Design of Structures
82.515 (CVG 7124)	Advanced Finite Element Analysis in Structural Mechanics
82.523 (CVG 7125)	Theory of Structural Stability
82.524 (CVG 7126)	Behaviour of Steel Structures
82.525 (CVG 7127)	Analysis of Elastic Structures
82.526 (CVG 7128)	Prestressed Concrete
82.527 (CVG 7129)	Advanced Structural Design
82.528 (CVG 7130)	Advanced Reinforced Concrete
82.560 (CVG 7131)	Project Management
82.563 (CVG 7132)	Computer-Aided Design of Building Structures
82.570 (CVG 7133)	Special Topics. Topics covered include: Building Design and Construction; Engineered Masonry Behaviour and Design; Advanced Methods in Computer-Aided Design; Statistics, Prob-

abilities and Decision Making: Applications in Civil Engineering

83.520 (CVG 5141) Plastic Design of Steel Structures

83.521 (CVG 5142) Structural Dynamics

83.522 (CVG 5143) Advanced Structural Steel Design

83.523 (CVG 5145) Theory of Elasticity

83.524 (CVG 5147) Theory of Plates and Shells

83.525 (CVG 5149) Energy Methods and Elastic Stability of Structures

83.526 (CVG 5150) Advanced Concrete Technology

83.527 (CVG 5151) Flow Induced Vibration

83.528 (CVG 5152) Steel Bridges

83.529 (CVG 5153) Wind Engineering

83.530 (CVG 5340) Advanced Reinforced Concrete Design

83.531 (CVG 5341) Finite Element Methods

83.532 (CVG 5342) Numerical Methods of Structural Analysis

83.533 (CVG 5343) Finite Element Methods II

83.534 (CVG 5347) Dynamics of Structures

83.535 (CVG 5348) Prestressed Concrete Design

Transportation

82.534 (CVG 7150) Intercity Transportation, Planning and Management

82.535 (CVG 7151) Traffic Engineering

82.536 (CVG 7152) Highway Materials

82.537 (CVG 7153) Urban Transportation and Management

82.538 (CVG 7154) Geometric Design

82.539 (CVG 7155) Intercity Transportation Supply

82.540 (CVG 7160) Case Studies in Traffic Engineering

82.541 (CVG 7156) Transportation Economics and Policy

82.542 (CVG 7159) Transportation Terminals

82.543 (CVG 7158) Airport Planning

82.574 (CVG 7157) Special Topics in Transportation Planning and Technology Engineering Management

Water Resources

83.550 (CVG 5110) Hydraulics of Open Channels

83.551 (CVG 5111) Hydraulic Structures

83.552 (CVG 5114) Hydraulics and Porous Media

83.553 (CVG 5115) Advanced Fluid Mechanics

83.554 (CVG 5116) Experimental Methods in Hydromechanics

83.555 (CVG 5117) Applied Hydrodynamics

83.556 (CVG 5120) Water Resources Systems

83.557 (CVG 5121) Physical Hydrology

83.558 (CVG 5122) Groundwater and Seepage

83.559 (CVG 5123) Advanced Topics in Hydrology

83.560 (CVG 5124) Dispersion Processes in Hydrologic Flows

83.561 (CVG 5125) Statistical Methods in Hydrology

83.562 (CVG 5126) Stochastic Hydrology

83.563 (CVG 5127) Hydrologic Systems Analysis

83.564 (CVG 5128) Water Resources Planning and Policy

83.565 (CVG 5129) Applied Hydrology

83.566 (CVG 5131) River Engineering

83.567 (CVG 5140) Irrigation and Drainage

83.568 (CVG 5154) Water Supply and Sanitation in Developing Countries

83.580 (CVG 5540) Irrigation et Drainage

83.581 (CVG 5554) Approvisionnement en Eau et Assainissement dans les Pays en Voie de Développement

Environmental

83.590 (CVG 5130) Wastewater Treatment Process Design

83.591 (CVG 5132) Unit Operations of Water Treatment

83.592 (CVG 5136) Design of Pollution Control Systems

83.593 (CVG 5139) Environmental Assessment of Civil Engineering Projects

83.594 (CVG 5330) Pollution Control Engineering

83.595 (CVG 5331) Experimental Methods in Pollution Control

83.596 (CVG 5332) Solid Waste Disposal

83.597 (CVG 5334) Chemical Analysis for Environmental Engineering

83.599 (CVG 5339) Evaluation des Effets de Projets en Génie Civil sur l'Environnement

Seminars and Directed Studies

82.596 (CVG 7180) Engineering Directed Studies

83.570 (CVG 5350) Special Directed Studies to to

83.579 CVG 5350) Etudes Dirigées

Projects and Theses

82.590 Engineering Project

82.599 M.Eng. Thesis

82.699 Ph.D. Thesis

CVG 6000 Civil Engineering Report/Rapport en Génie Civil

CVG 6001 Thesis Research in Civil Engineering I (Fall trimester)

Recherche en Vue de la Thèse de Maîtrise en Génie Civil I (trimestre d'automne)

CVG 6002 Thesis Research in Civil Engineering II (Winter trimester)

Recherche en Vue de la Thèse de Maîtrise en Génie
Civil II (trimestre d'hiver)
CVG 6003 Thesis Research in Civil Engineering III
(Spring trimester)
Recherche en Vue de la Thèse de Maîtrise en Génie
Civil III (trimestre du printemps)
CVG 7999 M.A. Sc. Thesis/Thèse
CVG 9998 Comprehensive Examination (Ph.D.)
Examen Général de Doctorat
CVG 9999 Ph.D. Thesis/Thèse

Department of Electronics

The Department

Chairman of the Department: M.A. Copeland

Departmental Supervisor of Graduate Studies:

J.S. Wight

Programs of study and research leading to the master's and Ph.D. degrees in electrical engineering are offered through the Ottawa-Carleton Institute for Research and Graduate Studies in Electrical Engineering. The institute, established in 1983, combines the resources of Carleton University and the University of Ottawa. For further information, including admission and program requirements, see page 112.

Areas of specialization in the Department of Electronics include:

Solid State Devices

Semiconductor device development; device modeling; device innovation; new device processes; small geometry devices

Integrated Circuit Engineering

Design and development of linear and digital integrated circuits, fabrication processes and test techniques; MOS and bipolar ICs; VLSI, computer-aided circuit design; laser processing

Solar Energy Conversion

Photovoltaics; solar cells; materials studies for solar cells; arrays; systems for electricity generation; instrumentation for energy systems

Analog Signal Processing

Switched capacitor filters, transversal filters, CCD delay lines and operational amplifiers in analog signal processing applications

Circuits

Active filters; linear and nonlinear circuit design; computer-aided circuit design; phase-locked circuits, carrier and clock synchronizers

Microwave Electronics

Microwave amplifiers, oscillators, modulators, frequency converters, phase-shifters; use of FET and bipolar transistors, Schottky barrier, varactor, step recovery and PIN diodes; design using finline, microstrip, stripline, coax, and waveguide

Communications and Radar Electronics

Circuits for terrestrial and satellite communications; circuit implementation of digital modulation techniques; antenna and array design; communication channel characterization; optical communications circuits; radar transmitter and receiver design

The structure of courses offered allows a well-integrated master's or Ph.D. program of study to be chosen appropriately related to the field of thesis research. Device- and integrated-circuit-oriented courses cover: fabrication, semiconductor device theory, semiconductor device design, integrated circuit design and integrated circuit reliability. Circuit-oriented courses include: signal-processing electronics, microprocessor electronics, computer-aided circuit design, phase-locked circuits, filter circuits, RF and microwave circuits, antenna and array design. Systems-oriented courses cover: telecommunication transmission, telecommunication switching, optical fiber communications and radar systems.

Excellent facilities are available for the fabrication of solid state devices and integrated circuits for research purposes. These include a laboratory in which processes required in silicon monolithic technology can be carried out. Among equipment items are modern diffusion furnaces, facilities for thin-film deposition including a low-pressure chemical vapour deposition system, an epitaxial reactor system, a high-power cw Argon laser for laser annealing of silicon, facilities for photolithography and mask-making, plasma etching, thick film deposition, scribing, bonding, and automatic testing. The department has various computing facilities available for both circuit design and software development. A CAD laboratory, consisting of nineteen 68000-based microcomputers is available for integrated circuit design, analysis and layout, together with a Metheus workstation and a VLSI test station. The department has a VAX 11/750 for CAD software development. Also available is an Apollo workstation connected to an interdepartmental network which includes an FPS 164 attached processor. University facilities include interactive time-sharing and batch processing using a Honeywell Level 66 mainframe. A facility for photovoltaics research includes a microcomputer-controlled solar simulator for AMO, AM1, and AM2 solar spectra.

The department is well equipped for circuit and measurement work over the range from dc through 18 GHz, and including optical frequencies. Sophisticated special purpose facilities include network analyzer systems, amplitude analyzers, spectrum analyzers, a microwave link analyzer, time domain reflectometers, frequency synthesizers, data generators, error detectors and high-frequency oscilloscopes.

The research laboratories maintain extensive collaboration with government and industrial research and development agencies in the Ottawa area.

Graduate Courses*

The complete list of graduate courses in electrical engineering, available through the Ottawa-Carleton Institute, is given on page 113. The courses offered by the Department of Electronics are as follows:

- Engineering 97.541W1

Solar Electricity Generation

This course gives a comparative study of devices and techniques for the generation of solar electricity. Topics covered will include the basics of solar energy (solar spectrum, insolation, etc.); photovoltaics, with emphasis on silicon solar cells; photovoltaic arrays and systems; concentration; solar thermal electricity; thermoelectricity; wind-mills; tidal power; comparison with conventional hydro, coal, oil, and nuclear generating stations. The economics of solar energy and the prognosis for the future will also be discussed.

Edward Norman.

- Engineering 97.551F1

Passive Microwave Circuits

Circuit aspects of passive microwave components and systems, with emphasis on concepts employed in the design and use of passive microwave devices. Review of EM theory, transmission lines, and waveguides. Microwave network analysis. Scattering-matrix characterization of reciprocal microwave junctions and discontinuities. Ferrites, nonreciprocal junctions, isolators, and circulators. Design, characteristics, and use of microwave components, such as transformers, filters, hybrids, tuners, and directional couplers, with particular emphasis on their realization in stripline and microstrip integrated circuits.

B.A. Syrett.

- Engineering 97.555F1

Passive Circuit Theory

General description of networks, leading to matrix representation of n -terminal lumped and distributed

networks. Elements of matrix algebra as applied to networks. Properties of network functions; poles and zeros of driving point and transfer functions. Foster and Cauer canonic forms. Synthesis of lossless two-ports, single and double-terminated. Modern filter theory; approximation of characteristics by rational functions; Butterworth and Chebyshev approximations. General parameter filters; graphical design. Elliptic filters, predistortion. Phase response and group delay; all-pass and Bessel filters.

P.D. van der Puije.

- Engineering 97.557W1

Active Circuit Theory

Characterization of negative resistance one-port networks, signal generation and amplification. Active two-ports; y , z , h , k , chain and scattering parameters. Measurement of two-port parameters. Activity and passivity; reciprocity, non-reciprocity, and anti-reciprocity. Gyrator as a circuit element. Stability, inherent and conditional; power gain of conjugate and mismatched two-port amplifiers. Amplifier gain sensitivity. Oscillators, maximal loading, and frequency sensitivity. Active filter design; gyrator, negative immittance converter (NIC) and operational amplifier used as functional elements. Practical realization of gyrators and NICs. Active network synthesis.

Prerequisite: Engineering 97.555 or equivalent.

P.D. van der Puije.

- Engineering 97.559F1

Integrated Circuit Technology

Survey of technology used in integrated circuit fabrication. Crystal growth and crystal defects, oxidation, diffusion, ion implantation and annealing, gettering, chemical vapour deposition, etching, materials for metallization and contacting, and photolithography. Emphasis will be on technologies suitable for silicon LSI and VLSI, but GaAs processing will also be considered.

N.G. Tarr.

- Engineering 97.561

Telecommunications Engineering

This course provides an introduction to most aspects of classical telecommunications engineering as well as a treatment of selected current topics in the field. Topics covered include: telephony fundamentals; grade-of-service objectives; traffic theory; routing rules and alternative routing; national network architectures; local network architecture; echo, loss and delay considerations; functions of a switching centre; design, analysis and control of switching networks; pulse code modulation; companding; time division multiplexing; digital switching; baseband pulse transmission

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

theory; transmission system design; information theory; line coding; satellite transmission.

W. Grover.

● Engineering 97.562F1

Microwave Semiconductor Devices and Applications

Discussion of basic principles of operation of varactor diodes, parametric amplifiers, p-i-n diodes, microwave switches, limiters, and phase shifters. Schottky barrier devices, detector and mixer circuits. Avalanche transit-time microwave diodes, bulk gallium arsenide devices, microwave bipolar transistors, MESFET's, applications.

B.A. Syrett.

● Engineering 97.563W1

Communications Technology

This course introduces the student to the technology of communication systems showing the fundamental and implementation limitations of modern systems, such as high-capacity digital radio, spread spectrum, analog mobile radio and cable systems. Topics discussed in the course include non-ideal fading channels, noise theory, nonlinearities, and filter technology. The above topics are related to several modern operating systems, such as the North American long haul digital radio system, and the Japanese advanced mobile radio system.

D.R. Conn.

● Engineering 97.564

Radar Systems Engineering

Fundamentals: range equation, minimum detectable signal, radar cross-section, pulse repetition frequency, range ambiguities. Classes of Radar: CW, FM-CW, MTI, tracking, air surveillance, SSR, PAR, MLS, SAR, SLAR, OTH, 3D and bistatic radars. Radar subsystems: transmitters, antennas, receivers, processors, displays. Detection criteria: CFAR receivers, noise, clutter, precipitation. Waveform Design: ambiguity functions, pulse compression. Propagation characteristics: earth's curvature, refraction, diffraction, attenuation.

J.S. Wight.

● Engineering 97.565W1

Optical Fiber Communications

Transmission characteristics of and design considerations for multi-mode and single-mode optical fiber waveguides; materials, structures, and device properties of light-emitting diodes and laser light sources; photo-diodes, avalanche detectors; repeater design; coupling devices for fibers; noise generation and measurements; inter-modulation, cross-modulation, and non-linearity characterization; analog systems, digital systems, system

design accounting for component signal degradation; data bus systems.

J.C. Dymont, David Kahn, Richard Lowe and Roman Maciejko.

● Engineering 97.566W1

Phase-Locked Circuits

Phase-locked loop characteristics: fundamentals, stability, transient response, sinusoidal operation, noise performance, tracking acquisition and optimization. Phase-locked loop applications: synthesizers, carrier synchronizers and clock synthesizers.

J.S. Wight.

● Engineering 97.567F1

Antenna and Array Engineering

Design parameters: pattern, radiation intensity, directivity, EIRP, radiation impedance, effective area, antenna noise. Aperture fundamentals: near field, pattern synthesis, beam steering and focusing, beam dimensions and scan angle, side-lobe levels and aperture taper. Aperture antennas: pyramidal and corrugated horns; plane, parabolic and offset parabolic reflectors; shaped beam and multiple spot beam synthesis; slot, slotted waveguide and microstrip antennas. Phased array fundamentals: grating lobes, Z-transform, beam steering, periodic, Chebyshev, aperiodic arrays. Wire antennas: infinitesimal elements, dipoles, Yagi, rhombic, log periodic, loop, helix antennas, baluns.

J.S. Wight.

● Engineering 97.569W1

Nonlinear Microwave Devices and Effects

Construction of nonlinear microwave devices, their application in practical networks, and the mathematical treatment of their consequent behaviour. Nonlinear-resistance devices: power detectors, mixers, and frequency multipliers. Nonlinear-reactance devices: varactors, parametric circuits for frequency-multiplication, mixing and frequency-division, voltage-controlled oscillators. Exploitation of nonlinear phenomena in GaAs FETs. Effects of undesirable amplifier nonlinearity: intermodulation distortion, amplitude and phase nonlinearity, AM-to-PM conversion, cross-modulation.

R.G. Harrison.

● Engineering 97.580F1

Theory of Semiconductor Devices

Review of solid state physics underlying device mechanisms. Equilibrium and non-equilibrium conditions in a semiconductor. Physical theory of basic semiconductor device structures and aspects of design: PN junctions and bipolar transistors, field effect devices. Basic current transport relationships. Charge control theory. Modelling of

device mechanisms. Performance limitations of transistors.

A.R. Boothroyd.

● Engineering 97.581F1

Electronic Circuit Reliability

Basic considerations in electronic circuit reliability, with particular reference to integrated circuits. A brief introduction to reliability statistics. Probability density functions (for example, Gaussian, Log normal, Weibull, etc.). Reaction kinetics (Arrhenius relationship). Accelerated life testing: design of tests and analysis of results. Significance of differences (Chi-square test). Determination of confidence limits. Sampling plans: producer's and consumer's risk. Screening and Burn-in: MIL-M-38510 and MIL-STD-883. System reliability: FMECA, reliability-modelling, MIL-HDBK-217. Reliability physics. Failure modes and mechanisms of IC's, package and chip. Failure analysis tools and techniques, optical, infra-red, SEM, stroboscopic voltage contrast, X-ray microprobe, Auger analysis, ion microprobe. Reliability in IC design. Reliable design rules. Process control and qualification. Step-stress testing. Semiconductor test structures. VLSI reliability considerations.

D.V. Sulway.

● Engineering 97.582W1

Surface-Controlled Semiconductor Devices

Use of MOS capacitors for process control: measurement of surface state density, minority carrier lifetime, doping profiles. MOSFET theory: Pao-Sah model, charge-sheet model, short channel effects, punchthrough. Numerical analysis techniques applied to device modelling. Schottky diodes and related structures. MESFETs and MISFETs on III-V semiconductors.

Prerequisite: Engineering 97.580 or equivalent.

N.G. Tarr.

● Engineering 97.583

Computer-Aided Design II: Automated IC Synthesis

A number of topics related to computer synthesis of integrated circuits will be discussed. These topics will include automatic PLA/FSM (programmable logic array)/(finite state machine) compilers, silicon compilers and automatic test plan generators (ATPG).

Prerequisites: Engineering 97.586, some IC design experience as given, for example, by Engineering 97.584 and 97.585, and permission of the department.

E.F. Girczyc.

● Engineering 97.584F1

Integrated Circuit Engineering I

An integrated circuit design course with a strong

project orientation, to be followed by 97.585

second term. The design philosophies considered will be uncommitted gate array, Mead-Conway and standard gate-level CMOS design, including random logic. Computer aided design tools are available including IC layout, and logic and mixed-mode simulation (SPLICE) and electrical simulation (SPICE).

C.H. Chan.

● Engineering 97.585W1

Integrated Circuit Engineering II

A continuation of 97.584. Students will have reviewed and tested earlier designs in the course, and will initiate their own design of an integrated circuit and submit it for fabrication where the design warrants. This course will require considerable project time in our CAD lab.

C.H. Chan and M.A. Copeland.

● Engineering 97.586F1

Computer-Aided Design I: IC Design Aids

The course will cover a variety of analysis and verification computer-aided design (CAD) tools which assist a designer with both the electrical design and the layout of integrated circuits: circuit analysis, logic simulation, fault simulation, timing verification, connectivity checking, design/electrical rule checking, and layout extraction.

D.G. Agnew.

● Engineering 97.587W1

Microprocessor Electronics

This is a course for graduate engineers who are familiar with one or more of the common eight-bit microprocessors. Topics such as bit-sliced machines, innovative modern microprocessors, special purpose peripheral chips, dynamic memory design, error-correcting memories, interfacing techniques. Fabrication technology as it affects cost and performance will be discussed.

J.P. Knight.

● Engineering 97.588F1

Signal Processing Electronics

Signal processing from the viewpoint of analog circuit design. CCD's BBD's, transversal filters, recursive filters, switched capacitor filters, Z-domain analysis of filters to meet specifications, interfacing aspects between analog and digital, anti-alias filtering, A/D and D/A converters, CODECS. Noise in sampled analog circuits, dynamic range, signal to noise ratio. Operational amplifier considerations — in sampled analog circuits. Tradeoffs between sampled analog and digital approaches to signal processing.

M.A. Copeland.

- Engineering 97.589F1, W1

Advanced Topics in Electronics

A course dealing with selected advanced topics of recent interest in the broad field of solid state of devices, electronic circuits, and electromagnetics. Specified topics to be announced each year. Course usually given on a seminar basis with student's presentations on assigned topics.

- Engineering 97.590F1, W1, S1

Engineering Project I

A one-term course, carrying half-course credit, for students pursuing the course work M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented orally. This course may be repeated for credit.

- Engineering 97.591F2, W2, S2

Engineering Project II

A one-term course, carrying full-course credit, for students pursuing the course work M.Eng. program or the co-operative M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented orally. This course may be repeated for credit.

- Engineering 97.596F1, W1, S1

Directed Studies

Various possibilities exist for pursuing directed studies on topics approved by a course supervisor, including the above listed course topics where they are not offered on a formal basis.

- Engineering 97.599F4, W4, S4

M.Eng. Thesis

- Engineering 97.699F, W, S

Ph.D. Thesis

Department of Mechanical and Aeronautical Engineering

The Department

Chairman of the Department:

H.I.H. Saravanamuttoo

Departmental Supervisor of Graduate Studies:

M.J. Bibby

The Department of Mechanical and Aeronautical Engineering offers programs of study and research leading to M.Eng. degrees in Aeronautical Engineering, Materials Engineering, and Mechanical Engineering, and to Ph.D. degrees in Aeronautical and Mechanical Engineering. These degrees are offered through the Ottawa-Carleton Institute for Graduate Studies and Research in Mechanical and Aeronautical Engineering, which is jointly administered by the Department of Mechanical and Aeronautical Engineering at Carleton University, and the Department of Mechanical Engineering at the University of Ottawa. For further information, including admission and program requirements, see page 102.

Programs of research and study are offered in several areas:

- Aerodynamics
- Internal Gas Dynamics
- Heat Transfer
- Stress and Failure Analysis
- Vibration Analysis
- Computer-Aided Engineering
- Computer-Aided Design
- Robotics
- Vehicle (Performance and Safety) Engineering
- Nuclear Engineering
- Energy Systems Planning
- Energy Conversion and Utilization
- Manufacturing Engineering
- Materials Engineering

The department has a major research commitment, both analytical and experimental, to thermofluid-dynamic and mechanical problems of gas turbine engine design and operation. Current projects include flow prediction and analysis in turbomachines; two- and three-dimensional boundary layer behaviour; dynamics of gas turbine power plants; design and performance of highly loaded turbines; noise generation in fans, compressors, and turbines; noise propagation in acoustically treated ducts; stress, deformation, and vibration of compressor and turbine blades and discs; optimum design of blades and discs; finite element analysis; dynamics of high-speed rotors; electron beam

welding of refractory metals; failure modes of materials in extreme environments.

Another area of intense research effort in the department is computer-aided engineering. Activities in this field include computer-aided analysis (primarily the finite element method), computer-aided design and computer-aided manufacturing. Finite element projects include heat and fluid flow analyses, stress, deformation (manufacturing processes), vibration and fracture mechanics studies. Computer-aided engineering is well supported with a large Honeywell central facility, minicomputer, microprocessor equipment and relatively extensive graphics facilities.

As part of the faculty interest in transportation, the department is active in research on air and ground vehicle technology. Current studies include computational methods for steady and unsteady potential flows over complex configurations; aircraft noise; boundary layer separation and control; model simulation of snow drifting on airports and roadways. The Transport Technology Research Laboratory has been organized for ground transport studies; design and optimization of off-road vehicles; vehicle safety; anti-lock braking systems; vehicle-terrain interaction; effect of vibration on vehicle performance; dynamics of air-cushion and magnetically levitated vehicles; composite and structural elements.

Members of the department, in the Energy Research Group, are engaged in research on various aspects of energy conversion and utilization. In addition to the previously mentioned work on gas turbines, research is being undertaken on nuclear energy, coal gasification, effectiveness of energy end-use and air- and water-pollution problems associated with energy utilization. In the nuclear energy field, research is being undertaken in heat transfer and fluid flow aspects of CANDU and SLOWPOKE reactors, with a major effort on thermohydraulic problems in reactor safety. Work is also in progress on reactor safety in general, with a special emphasis on risk. Research activities in this field also include studies on the utilization of CANDU reactors for thermal energy supply as well as electrical generation and on applications of up-rated SLOWPOKE reactors to low-temperature industrial heating and to building energy needs.

Another area of interest is in design, and manufacturing and materials technology; in particular, there are programs on the properties of welded joints, heat treatment and forming studies. The Centre for Advanced Engineering and Design

has been established to provide an opportunity for the academic design community to interact with Canadian industry. Graduate studies and programs may be arranged in this area.

The departmental laboratories are well equipped for the various research activities described above, and these are supported by a machine shop and an electronics shop. In addition to the extensive laboratory facilities, the faculty maintains several small computers. The University's central computing facility is based on a dual processor Honeywell Level 66 computer; this facility is used for major computations and is accessible at a large number of remote terminals in the Mackenzie Building.

The extensive laboratory facilities of the National Research Council, and of the Department of Energy, Mines and Resources are also used, by special arrangement, for research and graduate studies of mutual interest. Strong contacts are maintained with the gas turbine and nuclear power industries.

Graduate Courses*

Only a selection of the courses listed below is given in a particular academic year.

● Engineering 88.500F1

Fundamental Fluid Dynamics

Differential equations of fluid motion. Subsonic flow: potential flow theory; outline of panel methods and flows over wings and bodies. Supersonic flow: oblique shock waves and Prandtl-Meyer expansions; flows over wings and bodies. Viscous flow: the boundary-layer approximation; outline of boundary-layer calculation methods; coupling of viscous and inviscid regions of flow.

S.A. Sjolander.

● Engineering 88.501W1

Theory of Viscous and Turbulent Flows

Navier-Stokes and boundary layer equations; mean flow equations for turbulent kinetic energy; integral formulations. Stability, transition, turbulence, Reynolds stresses; separation. Calculation methods, closure schemes. Compressibility, heat transfer, and three-dimensional effects.

S.A. Sjolander.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

● Engineering 88.503F1

Incompressible Non-Viscous Flow

The fundamental equations for non-viscous fluid flow; solution of two-dimensional and axisymmetric potential flows; low-speed airfoil and cascade theory; wing lifting-line theory.

R.J. Kind.

● Engineering 88.504W1

Compressible Non-Viscous Flow

Steady isentropic, frictional, and diabatic flow; shock waves; irrotational compressible flow, small perturbation theory and similarity rules; second-order theory, unsteady, one-dimensional flow.

R.J. Kind

● Engineering 88.508W1

Experimental Methods in Fluid Mechanics

Fundamentals of techniques of simulation of fluid dynamic phenomena. Theoretical basis, principles of design, performance and instrumentation of ground test facilities. Applications to aerodynamic testing (subsonic to hypersonic speeds); wind effects on structures; air and water pollution.

W.G. Richarz.

● Engineering 88.509W1

Environmental Fluid Mechanics Relating to Energy Utilization

Characteristics of energy sources and emissions into the environment. The atmosphere: stratification and stability, equations of motion, simple winds, mean flow, turbulence structure and dispersion near the ground. Flow and dispersion in groundwater, rivers, lakes and oceans. Physical and analytical modelling of environmental flows.

R.J. Kind.

● Engineering 88.510W1

Performance and Economics of Aircraft

Aircraft performance analysis with emphasis on factors affecting take-off, landing and economic performance; high lift schemes; direct and indirect operating costs; route analysis and operational problems.

R.J. Kind.

● Engineering 88.511F1

Dynamics and Aerodynamics of Low Speed Flight

Brief review of static stability theory. Euler's equations for rigid body motion; the linearized equations of motion; stability derivatives and their estimation. Longitudinal and lateral dynamic response of an aircraft to control and disturbance.

R.J. Kind.

● Engineering 88.514F1

Ground Transportation Systems and Vehicles

Performance characteristics, handling and direc-

tional stability, ride comfort and safety of various types of ground-vehicle systems including road vehicles, terrain-vehicle systems, guided transport systems, and advanced ground transport technology.

J.Y. Wong.

● Engineering 88.517W1
Experimental Stress Analysis

Introduction to theory of elasticity. Photo-elasticity: types of polariscopes, two- and three-dimensional stress fields, frozen patterns. Photo-elastic coatings. Strain gauges; gauge factors, sensitivity, calibration, and temperature compensation. Moiré fringes, brittle lacquers, mechanical strain gauges.

Robert Bell.

● Engineering 88.521W1
Methods of Energy Conversion

The course covers technical, economic and environmental aspects of developing methods of energy conversion, as applied to large-scale systems. Among topics included are: fuel cells, MHD, fusion, solar energy, wind, geo-thermal and tidal energy.

J.T. Rogers.

● Engineering 88.530F1
Acoustics and Noise

Fundamentals of vibrations of solids and fluids; plane waves; spherical waves. Transmission and reflection; acoustic impedance and matching. Resonators and filters. Absorption in fluids. Introduction to acoustic measurements; loudspeakers, microphones. Introduction to aero-acoustics and jet noise.

● Engineering 88.531W1
Aero-acoustics

Acoustic wave motion, the wave equation and solutions, acoustic impedance. Acoustic transmission; ducts, tubes; standing waves. Theory of jet noise; turbomachinery noise; noise suppression.

● Engineering 88.541F1
Turbomachinery

This course deals with the generalized performance of turbomachinery, and with the thermo- and aerodynamic design of axial and radial flow machines. The emphasis is on compressible flow machines.

S.H. Moustapha.

● Engineering 88.542W1
Gas Turbines

Interrelationship among thermodynamic, aerodynamic, and mechanical design. Ideal and real cycle calculations. Cycle optimization; turboshaft, turboprop, turbofan. Component performance. Off-

design performance; matching of compressor, turbine, nozzle. Twin-spool matching.

W.L. MacMillan.

● Engineering 88.543W1
Advanced Thermodynamics

The course covers three major topics: review of fundamentals from a consistent viewpoint, properties and equations of state, and applications and special topics. The third topic includes an introduction to statistical thermodynamics.

E.G. Plett.

● Engineering 88.547W1
Conductive and Radiative Heat Transfer

Analytical, numerical and analog solutions to steady-state and transient conduction heat transfer in multi-dimensional systems. Radiative heat exchange between black, gray, non-gray diffusive and specular surfaces, including effects of athermanous media.

E.G. Plett.

● Engineering 88.548W1
Convective Heat and Mass Transfer

Review of analogies between heat, mass and momentum transfer. Free and forced convection from theoretical and experimental viewpoint for laminar and turbulent flows in ducts and over flat plates and blunt bodies. Heat transfer-friction relationship in heat exchangers. Film and dropwise condensation. Boiling with forced and natural convection. Two-phase flow. Mass transfer in stationary, laminar and turbulent flow systems.

E.G. Plett.

● Engineering 88.549W1
Two-Phase Flow and Heat Transfer

Topics covered include basic equations of liquid-vapor and liquid-gas flows including choked flows and flow oscillations, heat transfer rates and critical heat fluxes. Applications to practical problems are emphasized.

J.T. Rogers.

● Engineering 88.550W1
Advanced Vibration Analysis

General theory of discrete multi-degree-of-freedom vibrating systems. Emphasis on numerical techniques of solving complex vibrating systems, with selected applications from aeronautical, civil, and mechanical engineering.

James Kirkhope.

● Engineering 88.561W1
Design Theory and Practice (Creative Problem Solving)

This course outlines problem-solving processes and how they can be applied in engineering design. The

student will be introduced to and be expected to practice various systematic and creative problem-solving techniques. The emphasis is on the student's learning methodologies rather than accumulating information. The techniques may be successfully applied in any engineering specialty.

Geza Kardos.

● Engineering 88.562F1

Failure Prevention (Fracture Mechanics and Fatigue)

The course deals with the design of engineering structures to ensure against failure due to fatigue or brittle fracture. It emphasizes an understanding of the nature of fatigue and brittle fracture, and thereby the selection of suitable material, geometry, and inspection procedures for the load and environmental condition intended.

● Engineering 88.565F1

Finite Element Analysis I

An introduction to the finite element methodology, with emphasis on applications to heat transfer, stress analysis, and fluid flow. The basic concepts of Galerkin's method, interpolation, numerical integration, and isoparametric elements are taught using simple examples.

C.L. Tan.

● Engineering 88.566W1

Finite Element Analysis II

Time marching heat flow problems with linear and nonlinear analysis. Static plasticity. Time-dependent deformation problems; viscoplasticity, viscoelasticity, and dynamic analysis. Isoparametric elements and numerical integration are used throughout.

J.A. Goldak.

● Engineering 88.567F1

The Boundary Integral Equation (BIE) Method
Introduction to integral equation. Potential theory: Dirichlet and Neumann problems in engineering practice. Two-dimensional BIE for harmonic problems. Constant line elements. Numerical treatment of BIE. Two-dimensional BIE for elastostatics. Isoparametric line elements. Numerical treatment of BIE and integration schemes. Use of BIE computer programs for solving problems in elastostatics and potential theory.

C.L. Tan.

● Engineering 88.568F1

Deformation of Materials

A general course for mechanical and civil engineers, dealing with the metallurgical and materials principles that control the mechanical properties and deformation of materials. Topics to be covered include elasticity, anelasticity, yield point phe-

nomena, plastic flow, strain hardening, Bauschinger effect, fracture, viscoelastic deformation.

J.D. Boyd.

● Engineering 88.570T1

Special Topics in Mechanical and Aeronautical Engineering

Courses in special topics related to mechanical engineering and aeronautical engineering, not covered by other graduate courses; course details will be available prior to registration.

Topics for 1985-86

● Instrumentation Techniques

An introduction for non-specialists to the principal concepts of digital and analog electronics with emphasis on data acquisition, processing and analysis; providing sufficient background for selection and design of instrumentation systems for laboratory or field use. Topics covered include digital logic systems, introduction to computer interfacing, semi-conductor components, operational amplifiers, overview of signal processing and noise in electronic systems. Several "hands on" sessions illustrate theory and practice.

W.G. Richarz.

● Robotics and Microprocessors Application

The history and an introduction to robotics methodology. Robots and manipulators; homogeneous transformations, kinematic equations, solving kinematic equations, differential relationships, motion trajectories, dynamics. Control; feedback control, compliance, servomotors, actuators, external and internal sensors, grippers and vision systems. Microprocessors and their application to robot control. Programming.

J.Z. Sasiadek.

● Engineering 88.596F1, W1, S1

Directed Studies

● Engineering 88.598F2, W2, S2

Independent Engineering Study

In this course, the student pursuing a master's degree by course work will carry out an independent study, analysis, and solution of an engineering problem or design project. The results will be given in the form of a written report and presented at a departmental seminar. The study will be carried out under the general direction of a faculty member.

M.J. Bibby and others.

● Engineering 88.599F4, W4, S4

M.Eng. Thesis

● Engineering 88.699F, W, S

Ph.D. Thesis

Other Courses of Particular Interest

Civil Engineering

- 82.511 Introductory Elasticity
- 82.512 Advanced Elasticity
- 82.513 Finite Element Methods in Stress Analysis
- 88.524 Behaviour of Steel Structures
- 82.534 Intercity Transportation, Planning, and Management

Systems and Computer Engineering

- 94.501 Simulation and Modelling
- 94.504 Computer Methods in Industrial Engineering
- 94.505 Optimization Theory and Methods
- 94.552 Advanced Linear Systems
- 94.553 Stochastic Processes

Physics

- 75.511 Classical Mechanics and Theory of Fields
- 75.447 Statistical Physics (Statistical Thermodynamics)

Mathematics and Statistics

- 70.446 Hydrodynamics and Elasticity
- 70.486 Numerical Analysis
- 70.586 Numerical Analysis

The Ottawa-Carleton Institute for Graduate Studies and Research in Mechanical and Aeronautical Engineering

The Institute

Director of the Institute: Yung Lee

Established in 1983, the institute combines the research strengths and resources of the Departments of Mechanical and Aeronautical Engineering at Carleton University and Mechanical Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the institute in a range of fields of mechanical and aeronautical engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research. Requests for information and applications for admission may be sent to the graduate studies officer of either one of the participating departments.

Members of the Institute

The "home" department of each member is indicated by (C) for the Department of Mechanical and Aeronautical Engineering, Carleton University, and by (O) for the Department of Mechanical Engineering, University of Ottawa.

Robert Bell, *Finite Element Stress Analysis, Fatigue, Fracture Mechanics* (C)
M.J. Bibby, *Manufacturing Engineering, Materials* (C)
S.C. Cheng, *Heat Transfer, Numerical Methods* (O)
T.C. Currie, *Heat Transfer, Numerical Methods* (C)
M.C. de Malherbe, *Design, Manufacturing Engineering* (C)
Atef Fahim, *CAD/CAM, Controls* (O)
R.C. Flanagan, *Dynamics, Internal Combustion Engines* (O)
J.A. Goldak, *Computer-Integrated Manufacturing Software, Automatic Finite Element Analysis* (C)
D.J. Gorman, *Vibrations* (O)
D.C. Groeneveld, *Heat Transfer, Two Phase Flow* (O)
Y.M. Haddad, *Applied Mechanics, Finite Element Analysis* (O)
W.L. Hallett, *Fluid Mechanics and Combustion* (O)
Geza Kardos, *Design, Fracture Mechanics, Composites* (C)
R.J. Kind, *Aerodynamics, Wind Engineering* (C)
James Kirkhope, *Vibrations, Finite Element Analysis* (C)
A.S. Krausz, *Fracture, Plasticity* (O)

Yung Lee, *Heat Transfer, Nuclear* (O)
Shaukat Mirza, *Vibrations, Stress Analysis* (O)
M.B. Munro, *Composite Materials, Biomedical Engineering* (O)
E.G. Plett, *Energy Systems* (C)
David Redekop, *Applied Mechanics* (O)
W.G. Richarz, *Aeronautical Engineering, Acoustics* (C)
J.T. Rogers, *Heat Transfer, Thermofluids, Nuclear Engineering* (C)
Martha Salcudean, *Heat Transfer, Computational Fluid Mechanics* (O)
H.I.H. Saravanamuttoo, *Aeronautical Engineering, Gas Turbine Analysis* (C)
J.Z. Sasiadek, *Control Systems, Robotics* (C)
S.A. Sjolander, *Aeronautical Engineering, Fluid Mechanics* (C)
C.L. Tan, *Numerical Stress Analysis, Fracture Mechanics* (C)
Stavros Tavoularis, *Fluid Mechanics, Experimental Techniques* (O)
J.Y. Wong, *Vehicle Engineering, Transportation* (C)

Master's Degree

Admission Requirements

The normal requirement for admission to the master's program is a bachelor's degree with at least high second-class standing in mechanical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit is one hour/week for one term (13 weeks). The requirements for the master's degree by thesis are:

- Equivalent of 18 course credits
- Participation in the Mechanical and Aeronautical Engineering seminar series; and
- Thesis.

The requirements for the master's degree by course work are: 36 course credits or 27 course credits plus a project.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree in mechanical or aeronautical engineering or a related discipline. Students who have been admitted to the master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.

Program Requirements

The requirements for the Ph.D. degree (from the master's degree) are:

- 18 course credits
- Participation in the Mechanical and Aeronautical Engineering seminar series
- Successful completion of a qualifying examination; and
- Thesis. The examining board for all theses will include professors from both departments and an external examiner who is a member of neither University.

Students who have been permitted to transfer into the Ph.D. program from a master's program require 36 course credits for the Ph.D.

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or the advisory committee. The available graduate courses are listed below. Course descriptions are to be found in the departmental section of the calendar concerned. All courses are of one term duration. The following codes identify the department offering the course:

"88" Department of Mechanical and Aeronautical Engineering, *Carleton University*

"89" Department of Mechanical Engineering, *University of Ottawa*.

Only a selection of courses listed is given in a particular academic year.

88.500 (MCG 5300)	Fundamental Fluid Dynamics
88.501 (MCG 5301)	Theory of Viscous and Turbulent Flows
88.503 (MCG 5303)	Incompressible Non-Viscous Flow
88.504 (MCG 5304)	Compressible Non-Viscous Flow

88.508 (MCG 5308)	Experimental Methods in Fluid Mechanics
88.509 (MCG 5309)	Environmental Fluid Mechanics Relating to Energy Utilization
88.510 (MCG 5310)	Performance and Economics of V/STOL Aircraft
88.511 (MCG 5311)	Dynamics and Aerodynamics of Low Speed Flight
88.514 (MCG 5314)	Ground Transportation Systems and Vehicles
88.517 (MCG 5317)	Experimental Stress Analysis
88.521 (MCG 5321)	Methods of Energy Conversion
88.530 (MCG 5330)	Acoustics and Noise
88.531 (MCG 5331)	Aero-Acoustics
88.541 (MCG 5341)	Turbomachinery
88.542 (MCG 5342)	Gas Turbines
88.543 (MCG 5343)	Advanced Thermodynamics
88.547 (MCG 5347)	Conductive and Radiative Heat Transfer
88.548 (MCG 5348)	Convective Heat and Mass Transfer
88.549 (MCG 5349)	Two-Phase Flow and Heat Transfer
88.550 (MCG 5350)	Advanced Vibration Analysis
88.561 (MCG 5361)	Design Theory and Practice
88.562 (MCG 5362)	Failure Prevention
88.565 (MCG 5365)	Finite Element Analysis I
88.566 (MCG 5366)	Finite Element Analysis II
88.568 (MCG 5368)	Deformation of Materials
88.570 (MCG 5370)	Special Topics in Mechanical and Aeronautical Engineering
88.596 (MCG 5396)	Directed Studies
89.501 (MCG 5101)	Theory of Elasticity
89.502 (MCG 5102)	Advanced Stress Analysis
89.503 (MCG 5103)	Theory of Perfectly Plastic Solids
89.504 (MCG 5104)	Theory of Plates and Shells
89.505 (MCG 5105)	Continuum Mechanics
89.507 (MCG 5107)	Advanced Dynamics with Applications
89.508 (MCG 5108)	Finite Element Analysis I
89.509 (MCG 5109)	Finite Element Analysis II
89.511 (MCG 5111)	Gas Dynamics
89.514 (MCG 5114)	Analysis and Design of Pressure Vessels
89.517 (MCG 5117)	Strength and Fracture of Composite Materials
89.518 (MCG 5118)	Introduction to Plasticity
89.519 (MCG 5119)	Introduction to Fracture Mechanics
89.525 (MCG 5125)	Fatigue of Materials and Structures
89.526 (MCG 5126)	Deformation of Materials
89.531 (MCG 5131)	Heat Transfer by Conduction
89.532 (MCG 5132)	Heat Transfer by Convection

- 89.533 (MCG 5133) Heat Transfer by Radiation
- 89.534 (MCG 5134) Heat Transfer with Phase Change
- 89.536 (MCG 5136) Special Studies in Fluid Mechanics and Heat Transfer
- 89.537 (MCG 5137) Special Studies in Solid Mechanics and Materials
- 89.538 (MCG 5138) Advanced Topics in Mechanical Engineering
- 89.541 (MCG 5141) Advanced Thermodynamics
- 89.551 (MCG 5151) Viscous Flow Theory
- 89.552 (MCG 5152) Theory of Turbulence
- 89.555 (MCG 5155) Inviscid Flow Theory
- 89.556 (MCG 5156) Experimental Fluid Mechanics
- 89.557 (MCG 5157) Computational Fluid Mechanics
- 89.558 (MCG 5158) Industrial Fluid Mechanics
- 89.561 (MCG 5161) Environmental Engineering
- 89.566 (MCG 5166) Nuclear Engineering Fundamentals
- 89.574 (MCG 5174) Fundamentals of Transport Processes
- 89.581 (MCG 5181) Mechanical Vibrations
- 89.582 (MCG 5182) Theory of Elastic Instability
- 89.591 (MCG 5191) Combustion I
- 89.592 (MCG 5192) Combustion II
- 89.548 (MCG 5551) Théorie d'écoulement visqueux
- 89.549 (MCG 5552) Théorie de turbulence
- 89.550 (MCG 5557) Méthodes numériques en mécanique des fluides

Department of Systems and Computer Engineering

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The Department

Chairman of the Department: B.A. Bowen
Departmental Supervisor of Graduate Studies:
D.D. Falconer

The Department of Systems and Computer Engineering offers programs of study and research leading to the M.Eng. and Ph.D. degrees in Electrical Engineering. These degrees are offered through the Ottawa-Carleton Institute for Research and Graduate Studies in Electrical Engineering which is jointly administered by the Department of Systems and Computer Engineering and the Department of Electronics at Carleton University, and the Department of Electrical Engineering at the University of Ottawa. For further information, including admission and program requirements, see page 112.

A program leading to the M.Sc. degree in Information and Systems Science is offered in co-operation with the Department of Mathematics and Statistics. In addition, a program leading to the M.C.S. degree in Computer Science is offered jointly with the School of Computer Science, the Department of Mathematics and Statistics, and the Department of Computer Science at the University of Ottawa.

The departmental program centers upon the analysis and design of systems whose primary function is the processing of information. Within this context, four interrelated areas of study receive major attention:

- Computer Communications and Database Systems
- Communications and Signal Processing
- Computer Systems Engineering
- Modelling, Simulation, Optimization and Control

An integrated course program provides students with the fundamental basics, and allows specialization in one or more of the above areas as desired. The research program emphasizes the development and application of modern methods of information systems engineering pertinent to these areas. Work undertaken includes both theoretical studies and the related problems of practicable realizations. Specific research topics are often associated with one or more major projects, such as the Micro-processor Systems Development Laboratory.

Computing systems play a central role in the research and teaching activities of the department. The facilities available to the student include

interactive time-sharing and remote batch terminals linked to the University's Honeywell Level 66 digital computer and several small- to medium-sized computers available within the department. These include a VAX 11/750 and four SUN work-stations on an Ethernet local area network, a PDP11/55, PDP11/60, GT44, seven LSI/11's and many other microcomputers. Applications include information storage and retrieval, communications, signal processing, computer system design, and studies of office automation.

Full advantage is taken within the department of the technology-oriented government/industry/university complex in the Ottawa area. Co-operative projects exist with the Department of Communications, Communications Research Centre, NRC, Bell Northern Research Laboratories, Transport Canada, and Gandalf.

Students wishing to pursue a computing specialization in systems engineering may be required to take appropriate undergraduate computing science courses for which credit may be allowed.

M.Sc. Program in Information and Systems Science

This program is administered jointly by the Department of Mathematics and Statistics and the Department of Systems and Computer Engineering, and leads to an M.Sc. (Information and Systems Science). Intended primarily for students whose first degree is not in electrical engineering, it allows candidates to pursue studies in information systems engineering, communications and signal processing, computing science, or mathematical systems theory.

Applicants who desire admission to the information and systems science program are required to have an honours degree in a related discipline, with at least three years of mathematics and a strong undergraduate preparation in computer science; otherwise the general regulations apply. The normal program consists of eight half-courses, of which two must be taken in the Department of Mathematics and Statistics, and a thesis.

The program is more fully described on page 135 of this calendar.

Master of Computer Science

The Master of Computer Science (M.C.S.) degree program is offered by the School of Computer Science, the Department of Systems and Computer Engineering, and the Department of Mathematics and Statistics. The program is offered jointly with the Department of Computer Science at the University of Ottawa; hence, students are also able to take courses offered there.

Applicants to the M.C.S. program are required to have an honours degree in computer science (or the equivalent). The program is fully described, with a list of courses, on page 117 of this calendar.

Graduate Courses*

● Engineering 94.501W1

Simulation and Modelling

Simulation of continuous and discrete processes, with emphasis on the latter. Model building. Continuous time systems: analog models, digital approximations; continuous simulation languages. Simulation of discrete event-oriented processes. Specialized simulation languages: GPSS, SIMSCRIPT, GASP, SIMPAC. Monte Carlo methods. Experimental design and statistical analysis of results.

C.M. Woodside.

● Engineering 94.504F1

Computer Methods in Industrial Engineering

Linear programming; simplex and revised simplex methods; duality and post-optimal analysis; applications in health care delivery; integer programming; network models and algorithms, shortest path and minimum cost flow problems; application to computer communication network routing problems and urban traffic problems; equilibrium traffic assignment, Wardrop's conditions; critical path methods.

Bernard Pagurek.

● Engineering 94.505W1

Optimization Theory and Methods

A second-level course in optimization theory and computer-oriented optimization methods. Lagrange's method of undetermined multipliers. Unconstrained optimization: steepest-descent, Newton-Raphson, conjugate gradient, variable metric, and Powell-Zangwill methods. Nonlinear programming: Kuhn-Tucker conditions, saddle point theory and dual problems, computational techniques. Application to nonlinear engineering system identification, network synthesis problems, filter design. Function space techniques and introduction to optimal control.

Bernard Pagurek.

● Engineering 94/95.507F1

Expert Systems

Expert systems is a special field of artificial intelligence dealing with the design and construction of programs that provide information at the level of an "expert" in a specific area of interest. The existing expert systems and the current research in this area will be surveyed. Typical expert systems deal with medical diagnosis, computer system configuring, and programmer's assistants. Moreover, the systems are generally implemented using one of two paradigms: the rule-based approach or the actor-based approach. Both approaches will be considered in depth. Prototype software implementations are expected. Students will be expected to have a strong programming background, and to be able to familiarize themselves with LISP within the first week should they not already know it.

W.R. LaLonde.

● Engineering 94.511W1

Computer System Design for Performance

Methods for deriving quantitative design parameters within an architectural and configuration framework to meet design requirements on performance parameters, such as the throughput capability or response time of a system. Applications to embedded systems (signal processors, switches, etc.), multi-user systems, and tightly and loosely coupled distributed processors.

Prerequisites: Engineering 94.553 and 94.574 or equivalent, and a course in computer architecture.

C.M. Woodside.

● Engineering 94.517W1

Queueing, Scheduling, and Control of Information Systems

Methods for analyzing contention for resources, and the queue disciplines, priorities, and schedulers used for resolving contention. Emphasis is on applicable results, with approximations for com-

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

plex cases. Markovian analysis of standard simpler single queues and networks, including embedded processes. Networks of queues: product form, mean value analysis, computation, extended product form, Norton's theorem, asymptotic analysis. Scheduling, priority queues, and real-time control; design of queues.

Prerequisite: Engineering 94.553 or equivalent.
C.M. Woodside.

● Engineering 94.518W1

Topics in Information Systems

This course is designed to introduce the research student to recent developments in information systems design.

Prerequisite: Engineering 94.574 or permission of the department.

● Engineering 94.519W1

Teletraffic Engineering

Congestion phenomena in telephone systems, and related telecommunications networks and systems, with an emphasis on the problems, notation, terminology, and typical switching systems and networks of the operating telephone companies. Analytical queueing models and applications to these systems.

Prerequisite: Engineering 94.553 or the equivalent.

● Engineering 94.521F1

Computer Communication

Types of computer networks, performance criteria. OSI Layered Model with emphasis on transport, network and data-link layers. Examples of public networks. Routing and protocol efficiency. Queueing and analysis of networks. Local area networks, protocols and performance analysis of CSMA – CD, token passing and polling.

Prerequisite: Knowledge of probability theory including functions of a random variable or Engineering 94.553 (may be taken concurrently).

A.R. Kaye.

● Engineering 94.527W1

Distributed Processing Systems

Distributed processing systems definitions, objectives and applications. Protocols: theory and practical limitations, protocol specification and validation techniques. Layered protocol approach. ISO protocol model, transport, session, presentation and application levels. Design examples: interprocess communications, file transfer and distributed databases. Recovery of distributed systems from failure conditions.

Prerequisite: Engineering 94.521.

C.M. Woodside

● Engineering 94.531F1

System Design with ADA

Structured design of embedded computer systems with ADA. Requirements of a design language. Overview of ADA. Structured design principles. Notation and mechanisms for structured design with ADA. Canonical system structures. Design examples and issues drawn from areas of current interest, including intelligent terminals and computer communication protocols. Advanced ADA issues. Approaches to CAD. Implementation issues. Emphasis of this course is on design with ADA rather than on learning to program in ADA. However, students interested in ADA programming may be given the opportunity of working with an ADA development system.

Prerequisites: Real-time systems experience such as given by Engineering 94.433 and experience with at least one structured, high-level language, preferably PASCAL.

R.J.A. Buhr.

● Engineering 94.532W1

Systems Engineering Using VLSI Components

A comprehensive design methodology for implementing systems using VLSI components is expounded and illustrated. It establishes and illustrates this using digital signal processing as a case study. The first part of the course establishes the overall methodology, and places it in perspective with many existing approaches. It then systematically illustrates each step from user requirements, to logical design, to algorithm partitioning and architectural allocation. Examples include designs using existing components, as well as considerations for user-defined chips.

Prerequisites: Engineering 94.558 (or equivalent) and 94.531.

B.A. Bowen.

● Engineering 94.533F1

Digital Systems Engineering

This course is concerned with the totality of activity involved in creation of a digital system. It includes as components both hardware and software engineering, and extends these disciplines to an overall system. Topics include system design methodologies and strategies; representation and discipline mechanisms; constraints; reporting and documentation; interface to manufacturing; quality assurance and maintenance; design reviews; sub-specifications of software and hardware, and their integration and control. Examples are drawn from areas such as signal processing, computer communications, and intelligent terminals.

Prerequisite: Engineering 94.532.

B.A. Bowen.

● Engineering 94.534F1

Mini-Micro Applications

This course covers logical design of systems of sequential and concurrent programs for special-purpose applications of mini- and micro-processors. Intelligent terminal applications are particularly emphasized. Topics covered include virtual terminals; command decoders; device-independent I/O handlers; high-level communication protocols office automation functions; and human interface considerations.

Prerequisites: Engineering 94.571 and 94.527.

R.J.A. Buhr.

● Engineering 94.538F1

Computer Architecture and Parallel Processing
Introduction to parallel processing; parallel computer structures; memory and input/output subsystems; pipelining and vector processing; array processing; data flow and systolic computations; interconnection networks; software and other design fundamentals; examples.

Prerequisite: Engineering 94.457 or equivalent.

F.S. Wong.

● Engineering 94.539F1, W1

Advanced Topics in Digital Systems Design

A course dealing with recent and advanced topics in the field of digital systems design and related areas. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.

Prerequisites: Engineering 94.533 and permission of the department.

B.A. Bowen.

● Engineering 94.540W1

Topics in Office Automation

Course material is presented from three points of view: the technology, the individual user, and the organization. It demonstrates that successful approaches to office automation must take all three factors into account. Statistics and models of the office and associated markets: trends in technology, selected technologies, their roles, implications, and limitations. Human-machine interaction; what to look for, and what to design into machines for the office. Technology and the organization; productivity and quality of working life. Students will be required to undertake a substantial project either individually or in groups as part of the course.

Prerequisite: Permission of the department.

Students should have prior knowledge of computers and their uses.

A.R. Kaye.

● Engineering 94.552F1

Advanced Linear Systems

Review of basic linear systems: input-output relations, superposition, impulse response, convolution. Transform methods in systems analysis. Fourier and Laplace transforms. Time-frequency relationships. Discrete time systems, the Z transform. State space representation of the systems: basic concepts, canonical realizations. Observability and controllability of continuous and discrete time realization. Solution of state equations and modal decomposition. Linear state variable feedback and modal controllability. Abstract approach to state space realization methods. Geometric interpretation of similarity transformations. A.U.H. Sheikh.

● Engineering 94.553F1, W1

Stochastic Processes

Basic concepts of randomness, as applied to communications, signal processing, and queueing systems; probability theory, random variables, stochastic processes; random signals in linear systems; introduction to decision and estimation; Markov chains and elements of queueing theory. H.M. Hafez.

● Engineering 94.554F1

Principles of Digital Communication

Digital communication systems: characterization of information and noise signals; source encoding; communication processes; basic decision theory; optimum receivers. System performance; delay distortion, amplitude distortion, intersymbol interference, additive noise. Common digital modulation systems.

Prerequisite: Engineering 94.553 (may be taken concurrently).

H.M. Hafez.

● Engineering 94.557F1

Fundamentals of Discrete Systems

Introduction to the theory and applications of discrete mathematics to the analysis and design of the software and hardware of computers and computing systems. Digital machine theory: group theory and applications to finite state machines; algebras and combinatorial logic design, homomorphic maps and application to group codes; rings and fields and their application to cyclic codes. Graphs: graph and tree structures, directed graphs; applications to reliability, reachability and searches; classes of polynomial complete and incomplete problems with graph representation. Languages and grammars: finite automata, stack structured computers, Polish notation, queueing structures, and grammars.

S.A. Mahmoud.

● Engineering 94.558F1

Digital Systems Architecture

New architectural concepts in the design of computer systems are introduced. Discussions include system building blocks (arithmetic units, central processing units, control units, input/output and memory devices) and methods to achieve speed-up (instruction look-ahead, pipelining, memory interleaving, associative memory, SIMD and MIMD multiprocessing). Examples of current computer systems are used for discussions.

Prerequisite: Engineering 94.457 or equivalent.
F.S. Wong.

● Engineering 94.562W1

Digital Signal Processing: Algorithms, Hardware, and Software

Signal representations, Z transform and difference equations. Digital filters; recursive design techniques for FIR and IIR filters, quantization effects. Discrete Fourier transform: properties, correlation and convolution, chirp Z transform. Fast Fourier transform: algorithms and implementation. Random signal analysis: estimators, sampling distributions, averaging, correlation and spectral estimates, windowing for leakage suppression and stability improvement. Digital signal processing software: interaction of processor and software architectures, techniques for production of time efficient software on dsp chips, such as on the TI TMS 320. Speech analysis and synthesis, predictive encoding, and other current applications.

Prerequisites: Engineering 94.552 and 94.553 (may be taken concurrently).

L.R. Morris.

● Engineering 94.565W1

Advanced Digital Communication

Review of optimum reception for the non-distorting additive noise channel; intersymbol interference and equalization; efficient digital modulation techniques; timing and synchronization; discussion of selected topics, such as partial response, error detection and correction, multiple-access communication, spread spectrum modulation; information theory.

Prerequisite: Engineering 94.554.

D.D. Falconer.

● Engineering 94.566F1

Multi-Access Communications Systems

Selected topics in multi-user communications systems, such as telecommunications switching and multiplexing; multi-access protocols; local area networks; the integrated switched digital network; TDMA and FDMA satellite systems, packet and mobile radio systems; spread spectrum communi-

cation techniques; digital communication on optical fiber, subscriber loop, and CATV channels.

Prerequisite: Engineering 94.554 or equivalent.
D.D. Falconer.

● Engineering 94.567F1

Source Coding and Data Compression

Discrete and continuous sources: the rate distortion functions. Discrete source coding: Huffman coding, run length encoding. Continuous source coding: waveform construction coding; PCM, DPCM, delta modulation; speech compression by parameter extraction; predictive encoding; image coding by transformation and block quantization. Fourier and Walsh transform coding. Compression by tree coding. Applications to telecommunication signals and storage; speech, television, facsimile.

Prerequisite: Engineering 94.553 or equivalent.
D.D. Falconer.

● Engineering 94.568W1

Mobile Communications Systems

Channel characterization: multipath interference, Rayleigh fading, shadowing effects, selective fading, impulsive noise. Diversity techniques. Analog land mobile systems: FM and SSB systems. Digital land mobile systems: bit and block error rates, digital modulation systems, digitized speech signals. Conventional land mobile networks: trunked networks, access schemes. Cellular land mobile systems. Interference analysis for analog and digital systems.

Prerequisite: Engineering 94.554.

A.U.H. Sheikh.

● Engineering 94.569W1

Digital Television: Coding and Compression

Colour television theory: standard systems: NTSC, PAL, SECAM. Sampling and quantization for digital studios recording and transmission. Bandwidth compression: predictive, transform, entropy and other coding techniques. Effects of transmission errors. Evaluation methods.

D.C. Coll.

● Engineering 94.571F1

Mini/Microcomputer Operating System Design

Principles and practice of structured operating system design with emphasis on real-time, embedded systems. Concurrent programming: mechanisms and languages; design approaches and issues; run-time support requirements and organization (the nucleus); input/output organization. Differences between and examples of embedded and general purpose operating systems. Multi-processor and distributed system issues. Examples drawn from Multi-PASCAL, Concurrent PASCAL, Modula, ADA, Euclid, RMX86, UNIX and others.

Prerequisites: Real-time systems experience such as given by Engineering 94.433 and experience with at least one structured, high-level language, preferably PASCAL.

R.J.A. Buhr.

● Engineering 94.573F1

Integrated Database Systems

Physical and logical storage structures; database architecture; logical models of databases; the relational model; relational algebra and calculus; normal forms. Hierarchical model; IMS as an example. Network model; CODASYL DBTG approach; first order logic models and deductive querying. Design issues in distributed databases.

Prerequisite: Engineering 94.574 or equivalent.

Bernard Pagurek.

● Engineering 94.574F1

Elements of Computer Systems

A comprehensive overview of basic topics in computers which many engineering students may not have covered in their undergraduate programs. Subjects to be covered may include the following: system organization and architecture: CPUs, memories, instruction sets, addressing modes, data paths, I/O, etc., in 8085, PDP-11, and 370; microprogramming, machine language and assemblers; data types; data structures: queues, stacks, lists, trees; structured programming techniques and common algorithms; operating systems: components of basic systems; management of co-operating processes. This course is designed for graduate students without extensive undergraduate preparation in computer engineering (or the equivalent experience). Students with the equivalent of a bachelor's degree in electrical engineering (with a computer option), computer engineering, or computing science would normally proceed directly to courses for which Engineering 94.574 is a prerequisite.

Prerequisites: Programming experience in at least one high-level language, preferably PASCAL, and some experience with assembly language programming.

D.C. Coll.

● Engineering 94.576F1

Analytical Performance Models of Computer Systems

Analytical modelling techniques for performance analysis of computing systems. Theoretical techniques covered include single and multiple class queueing network models, together with a treatment of computational techniques, approximations, and limitations. Applications include scheduling, memory management, peripheral devices,

databases, multiprocessing, and distributed computing.

Prerequisite: Engineering 94.553.

C.M. Woodside.

● Engineering 94.577W1

Teleprocessing Software Design

Review of basic teleprocessing functions and sub-systems: code conversion, line control, error control, synchronization. Teleprocessing devices and networks. Data communications systems and host computer interface configurations. Modular software design for front-end processors, message switches, remote concentrators, and intelligent terminals.

Prerequisites: Engineering 94.574 or equivalent and 94.521.

S.A. Mahmoud.

● Engineering 94.579F1, W1

Advanced Topics in Software Engineering

A course dealing with recent and advanced topics in the field of software engineering and related areas. Primary references are recent publications in the field. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.

Prerequisites: Engineering 94.531 and permission of the department.

R.J.A. Buhr.

● Engineering 94.582W1

Topics in Information and Systems Science

Fundamental results in design and analysis of efficient computer algorithms for large, complex problems. Areas of application include data manipulation, computer networks, queueing systems, and optimization.

(Also offered as Mathematics 70.582)

R.J.A. Buhr.

● Engineering 94.583W1

Logic Programming

Review of relational databases, first order predicate calculus, semantics of first order models, deductive querying. Proof theory, unification and resolution strategies. Introduction to Prolog, and/or parallelism and Concurrent Prolog. Applications in knowledge representation and rule based expert systems.

Prerequisites: An introduction to databases as given in Engineering 94.305 or 94.573.

Bernard Pagurek.

● Engineering 94.584F1, W1

Advanced Topics in Communications Systems

Recent and advanced topics in communications systems. Students registered in the course are

expected to present one or more lectures or seminars on assigned topics.

Prerequisites: Engineering 94.565 and permission of the department.

D.D. Falconer.

- Engineering 94.589W1

Advanced Topics in Measurements and Models

Recent and advanced topics in optimization, queueing theory, dynamic systems, estimation for systems analysis, the theory of networks, and similar areas. A seminar course for Ph.D. students and (with permission) advanced master's students. Bernard Pagurek and C.M. Woodside.

- Engineering 94.590F1, W1, S1

Systems Engineering Project

Students pursuing the non-thesis M.Eng. program will conduct an engineering study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a typewritten report and presented at a departmental seminar.

- Engineering 94.591F2, W2, S2

Systems Engineering Project

Project similar to Engineering 94.590, but either of greater scope or longer duration. Results will be given as a typewritten report and presented in a seminar.

- Engineering 94.592T2

Systems Engineering Project

(Same description as Engineering 94.591, but spread over two terms)

- Engineering 94.593F2, W2, S2

Co-operative Program Project

A one-term course, carrying a full-course credit, for students pursuing the co-operative M.Eng. program. An engineering study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented orally. This course may be repeated for credit.

- Engineering 70/94/95.595F4, W4, S4

M.C.S. Thesis

- Engineering 94.596F1, W1, S1

Directed Studies

- Engineering 70/94.598F3, W3, S3

M.Sc. Thesis in Information and Systems Science

- Engineering 94.599F4, W4, S4

M.Eng. Thesis

- Engineering 94.699F, W, S

Ph.D. Thesis

Ottawa-Carleton Institute for Research and Graduate Studies in Electrical Engineering

Director of the Institute: S.S. Stuchly

Established in 1983, the institute combines the research strengths and resources of the Departments of Electronics and of Systems and Computer Engineering at Carleton University and the Department of Electrical Engineering at the University of Ottawa. Programs leading to master's and Ph.D. degrees are available through the institute in a wide range of fields of electrical engineering. Graduate students may pursue their research on either university campus, depending upon the choice of supervisor. Registration will be at the university most appropriate to the student's program of studies and research. Requests for information and applications for admission may be sent to the director, or the graduate studies officer of any of the participating departments.

Members of the Institute

The "home" department of each member is indicated by (OE) for the Department of Electrical Engineering, University of Ottawa; (CE) for the Department of Electronics, Carleton University; (CS) for the Department of Systems and Computer Engineering, Carleton University.

N.U. Ahmed, *Systems Theory, Optimal Control* (OE)
Prakash Bhartia, *Microwaves, Antennas, Instrumentation* (OE)
A.R. Boothroyd, *Solid State Devices, ICs, CAD* (CE)
B.A. Bowen, *Digital Architecture* (CS)
R.J.A. Buhr, *Software Engineering, Protocols, CAD* (CS)
C.H. Chan, *VLSI Circuits, Systems* (CE)
K.-W. Chiang, *Fault-Tolerant Computing, VLSI* (OE)
Sorin Cohn-Sfetcu, *Telecommunications* (OE)
D.C. Coll, *Telecommunications and Computers* (CS)
M.A. Copeland, *ICs, Analog Signal Processing, CAD* (CE)
George Costache, *Electromagnetic Engineering* (OE)
S.R. Das, *Digital Systems* (OE)
David Falconer, *Digital Communications, Signal Processing* (CS)
Kamilo Fehér, *Digital Communications, Transmission, Modulation* (OE)
Peter Galko, *Communications* (OE)
N.D. Georganas, *Computer-Communications, Mobile Radio* (OE)

D.T. Gibbons, *Digital and Biomedical Electronics, Microprocessors* (OE)
E.F. Girczyc, *Silicon Compilers* (CE)
Morris Goldberg, *Image Processing, Pattern Recognition* (OE)
David Goodenough, *Image Processing, Pattern Recognition* (OE)
Faruk Hadziomerovic, *Queueing, Operating Systems, Microprocessors* (CS)
H.M. Hafez, *Digital Modulation, Packet Radio* (CS)
R.G. Harrison, *Microwaves, Non-linear Processes* (CE)
W.J.R. Hoefer, *Microwaves, Electromagnetic Theory* (OE)
Aluddin Javed, *Communications* (OE)
A.R. Kaye, *Office Automation* (CS)
J.P. Knight, *Logic Design, Microprocessors, CAD* (CE)
Moshe Krieger, *Computer Architecture, Microprocessor, CAM* (OE)
S.A. Mahmoud, *Distributed Databases, Packet Radio* (CS)
Vassilios Makios, *Microwaves, Fiber Optics* (CE)
L.R. Morris, *Signal Processing, Minicomputers* (CS)
Michel Ney, *Electromagnetic Engineering* (OE)
Bernard Pagurek, *Queueing, Databases* (CS)
J.S. Riordon, *Distributed Databases, Packet Radio* (CS)
K.F. Schenk, *Power Systems and Reliability* (OE)
A.U.H. Sheikh, *Mobile and Data Communications, Noise* (CS)
S.G.S. Shiva, *Information Theory, Coding Theory* (OE)
Andrew Smith, *Medical Instrumentation and Computing* (OE)
W.J.D. Steenaart, *Digital Communications, Signal Processing* (OE)
M.A. Stuchly, *Biomedical Effects of Microwaves* (OE)
S.S. Stuchly, *Microwaves, Antennas, Instrumentation* (OE)
B.A. Syrett, *Microwaves, Fiber Optical Communications* (CE)
N.G. Tarr, *Solid State Devices, Fabrication* (CE)
R.E. Thomas, *Solid State Technology, Solar Energy* (CE)
P.D. van der Puije, *Circuit Synthesis, Biomedical Engineering* (CE)
J.S. Wight, *Phase-locked Circuits, Microwaves, Antennas, Radar* (CE)
F.S. Wong, *Microprocessors, Computer Architecture* (CS)
C.M. Woodside, *Computer Performance, Networks, CAD Queueing* (CS)

Master's Degree

Admission Requirements

The normal requirement for admission to a master's program is a bachelor's degree with at least high second-class standing in electrical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the departmental chairman, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics).

At the University of Ottawa, master's programs with a thesis earn the Master of Applied Science degree, while other master's programs earn the Master of Engineering degree. At Carleton University, all master's programs earn the Master of Engineering degree.

Master's Degree by Thesis

- 18 course credits plus a thesis

Master's Degree by Course Work

- 27 course credits plus a project (nominally 6 credits)

Co-operative Master's Degree by Thesis

- 18 course credits plus a thesis

Co-operative Master's Degree by Course Work

- 24 course credits plus 2 projects (each conducted in one work term).

Participation in the co-operative master's program is subject to acceptance by a suitable sponsoring organization.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree with thesis in electrical engineering or a related discipline.

Program Requirements

The requirements for course work are specified in terms of credits: one credit = one hour/week for one term. Subject to the approval of the advisory committee, a student may take up to half of the course credits in the program in other disciplines (e.g., Mathematics, Computer Science, Physics).

- A minimum of 14 course credits

- A comprehensive examination involving written and oral examinations and a written thesis proposal
- A thesis which must be defended at an oral examination.

Graduate Courses

In all programs, the student may choose graduate courses from either university with the approval of the adviser or advisory committee. Graduate courses are listed below, grouped by subject area. Course descriptions may be found in the departmental section of the calendar concerned. All courses are of one term duration. Only a selection of courses listed is given in a particular academic year. The following codes identify the department offering the course.

Carleton University

94. Department of Systems and Computer Engineering

97. Department of Electronics

University of Ottawa

92. Department of Electrical Engineering

The CSI designation refers to the Department of Computer Science at the University of Ottawa. The ELG designation refers to the Department of Electrical Engineering at the University of Ottawa.

Communications and Signal Processing

94.519 (ELG 6119)	Teletraffic Engineering
94.554 (ELG 6154)	Principles of Digital Communication
94.562 (ELG 6162)	Digital Signal Processing
94.565 (ELG 6165)	Advanced Digital Communication
94.566 (ELG 6166)	Multi-Access Communications Systems
94.567 (ELG 6167)	Source Coding and Data Compression
94.568 (ELG 6168)	Mobile Communications Systems
94.584 (ELG 6184)	Advanced Topics in Communications Systems
97.561 (ELG 6361)	Telecommunications Engineering
97.563 (ELG 6363)	Communications Technology
97.564 (ELG 6364)	Radar Systems Engineering
97.565 (ELG 6365)	Optical Fiber Communications
92.519 (ELG 5119)	Stochastic Processes in Electrical Engineering
92.547 (ELG 7370)	Digital Telephony
92.549 (ELG 5174)	Satellite Communications I
92.551 (ELG 5177)	Satellite Communications II

- 92.552 (ELG 5178) Signal Analysis
 92.553 (ELG 5179) Statistical Communications
 92.554 (ELG 5372) Theory of Coding with Applications I
 92.555 (ELG 5373) Theory of Coding with Applications II
 92.556 (ELG 5375) Data Communication
 92.557 (ELG 5376) Digital Signal Processing I
 92.558 (ELG 5377) Digital Signal Processing II
 92.559 (ELG 5378) Image Processing Techniques
 92.560 (ELG 7172) Topics in Digital Signal Processing I
 92.561 (ELG 7173) Topics in Digital Signal Processing II
 92.565 (ELG 7177) Topics in Communications I
 92.566 (ELG 7178) Topics in Communications II
 92.584 (ELG 7371) Digital Modulation Techniques
- Distributed Computing and Computer Communications*
 94.521 (ELG 6121) Computer Communication
 94.527 (ELG 6127) Distributed Processing Systems
 94.540 (ELG 6140) Topics in Office Automation
 94.577 (ELG 6177) Teleprocessing Software Design
 92.567 (ELG 5374) Computer-Communication Networks
 92.568 (ELG 7170) Topics in Computer-Communication I
 92.569 (ELG 7171) Topics in Computer-Communication II
 92.580 (ELG 7570) Thèmes Choisis en Téléinformatique I
 92.583 (ELG 7571) Thèmes Choisis en Téléinformatique II
- Computers*
 94.507 (CSI 5307) Expert Systems
 94.511 (ELG 6111) Computer System Design for Performance
 94.518 (ELG 6118) Topics in Information Systems
 94.531 (ELG 6131) System Design with ADA
 94.532 (ELG 6132) Systems Engineering Using VLSI Components
 94.533 (ELG 6133) Digital Systems Engineering
 94.534 (ELG 6134) Mini-Micro Applications
 94.538 (ELG 6138) Computer Architecture and Parallel Processing
 94.539 (ELG 6139) Advanced Topics in Digital Systems Design
 94.558 (ELG 6158) Digital Systems Architecture
 94.571 (CSI 5117) Mini/Microcomputer Operating System Design
 94.573 (CSI 5115) Integrated Database Systems
- 94.574 (ELG 6174) Elements of Computer Systems
 94.576 (ELG 6176) Analytical Performance Models of Computer Systems
 94.579 (CSI 5112) Advanced Topics in Software Engineering
 94.582 (ELG 6182) Topics in Information and Systems Science
 94.583 (ELG 6183) Logic Programming
 97.587 (ELG 6387) Microprocessor Electronics
 92.573 (ELG 5194) Fault-Tolerant Computing
 92.574 (ELG 5189) Principles of Micro-programming
 92.575 (ELG 5190) Computer Architecture
 92.576 (ELG 5191) Principles of Microprocessors
 92.577 (ELG 5192) Microprocessor-Based Systems
 92.578 (ELG 5193) Multimicroprocessor Systems
 92.585 (ELG 7180) Topics in Sequential Machines
 92.587 (ELG 7186) Topics in Automata Theory
 92.588 (ELG 7187) Topics in Mini- and Micro-computer Systems
 92.589 (ELG 7381) Topics in Computer Architecture I
- Electromagnetic Engineering*
 97.551 (ELG 6351) Passive Microwave Circuits
 97.567 (ELG 6367) Antenna and Array Engineering
 97.569 (ELG 6369) Nonlinear Microwave Devices and Effects
 92.535 (ELG 5102) Microwave Circuits I
 92.537 (ELG 5104) Electromagnetic Waves — Theory and Application
 92.538 (ELG 7500) Thèmes Choisis en Micro-Ondes
 92.539 (ELG 5106) Microwave Integrated Circuits
 92.541 (ELG 5108) Electromagnetic Compatibility and Interference
 92.542 (ELG 5379) Numerical Methods in Electromagnetic Engineering
 92.543 (ELG 5700) Circuits de Micro-Ondes
 92.544 (ELG 7100) Topics in Microwaves
 92.545 (ELG 7101) Topics in Electromagnetics
- Electronics*
 97.541 (ELG 6341) Solar Electricity Generation
 97.555 (ELG 6355) Passive Circuit Theory
 97.557 (ELG 6357) Active Circuit Theory
 97.559 (ELG 6359) Integrated Circuit Technology
 97.562 (ELG 6362) Microwave Semi-conductor Devices and Applications
 97.566 (ELG 6366) Phase-Locked Circuits
 97.580 (ELG 6380) Theory of Semiconductor Devices
 97.581 (ELG 6381) Electronic Circuit Reliability

- 97.582 (ELG 6382) Surface-Controlled Semiconductor Devices
 97.583 (ELG 6383) Computer-Aided Design II: Automated IC Synthesis
 97.584 (ELG 6384) Integrated Circuit Engineering I
 97.585 (ELG 6385) Integrated Circuit Engineering II
 97.586 (ELG 6386) Computer-Aided Design I: IC Design Aids
 97.588 (ELG 6388) Signal Processing Electronics
 97.589 (ELG 6389) Advanced Topics in Electronics
 92.504 (ELG 5332) Electronics Design Techniques with Modern Integrated Circuits
 92.505 (ELG 5340) Digital Instrumentation
 92.506 (ELG 7132) Topics in Electronic Circuits I
 92.507 (ELG 7133) Topics in Electronic Circuits II

Power

- 92.510 (ELG 5140) Power System Analysis I
 92.511 (ELG 5141) Power System Analysis II
 92.512 (ELG 7140) Topics in Power Systems I
 92.513 (ELG 7141) Topics in Power Systems II

Systems Engineering Methods and Control

- 94.501 (CSI 5120) Simulation and Modelling
 94.504 (ADM 6185) Computer Methods in Industrial Engineering
 94.505 (CSI 5150) Optimization Theory and Methods
 94.517 (ELG 6117) Queueing, Scheduling, and Control of Information Systems
 94.552 (ELG 6152) Advanced Linear Systems
 94.553 (ELG 6153) Stochastic Processes
 94.557 (ELG 6157) Fundamentals of Discrete Systems
 94.589 (ELG 6189) Advanced Topics in Measurements and Models
 92.516 (ELG 5113) Probabilistic Systems
 92.523 (ELG 5155) Stochastic Optimal Control
 92.525 (ELG 5350) Optimal Control
 92.526 (ELG 5353) Techniques of Optimization of Distributed Parameter Systems
 92.527 (ELG 5355) Stability of Linear and Non-linear Systems
 92.529 (ELG 7113) Topics in Systems Engineering I
 92.530 (ELG 7114) Topics in Systems Engineering II

Seminars and Directed Studies

- 94.596 (ELG 6196) Directed Studies
 97.596 (ELG 6396) Directed Studies
 92.595 (ELG 5300S) Seminars

Projects and Theses

- 94.590 Systems Engineering Project
 94.591 Systems Engineering Project
 94.592 Systems Engineering Project
 94.593 Co-operative Program Project
 94.599 Master of Engineering Thesis
 94.699 Doctoral Thesis
 97.590 Engineering Project I
 97.591 Engineering Project II
 97.599 Master of Engineering Thesis
 97.699 Doctoral Thesis
 ELG 6000 Electrical Engineering Report
 ELG 6001 Thesis Research in Electrical Engineering I
 ELG 6002 Thesis Research in Electrical Engineering II
 ELG 6003 Thesis Research in Electrical Engineering III
 ELG 7999 M.A.Sc. Thesis
 ELG 8000 Co-Op Work Term I
 ELG 8001 Co-Op Work Term II
 ELG 9998 Comprehensive Examination (Ph.D.)
 ELG 9999 Ph.D. Thesis

School of Architecture

The School

Director of the School: Alberto Perez-Gomez

The School of Architecture does not offer a program at the graduate level. However, it does offer graduate courses, and members of the school participate in graduate programs offered by the Department of Civil Engineering, the Institute of Canadian Studies, the Faculty of Environmental Studies at York University, the Centre for Building Studies at Concordia University, and the Faculté de l'Aménagement at the Université de Montréal. Members of the school also supervise graduate research.

The Architectural Research Group operates within the school to co-ordinate and assist research and consulting activities.

Graduate Courses*

- Architecture 76.500F1, W1

Directed Studies in Canadian Architecture
Reading and research tutorials.

- Architecture 77.500F1, W1

Directed Studies in Building Technology
Reading and research tutorials.

- Architecture 78.500F1, W1

Directed Studies in Urban Planning and Design
Reading and research tutorials.

An honours degree or equivalent qualification in a relevant field, as well as permission of the school, is a required prerequisite for admission to these courses.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

The Committee

Chairman of the Committee: Frantisek Fiala

Supervisors of Graduate Studies in the Co-operating Departments: M.D. Atkinson, School of Computer Science; J.D. Dixon, Department of Mathematics and Statistics; D.D. Falconer, Department of Systems and Computer Engineering

Joint Carleton University/University of Ottawa Program Co-ordinating Committee Chairman:
M.D. Atkinson, School of Computer Science

The M.C.S. program includes graduate study and research leading to the degree of Master of Computer Science. Four broad areas of study are identified as follows:

Programming Systems and Languages

Database systems, operating systems, software methodology, software translators, language design

Theory of Computing

Analysis of algorithms, automata theory, formal languages, complexity, computability, logic and program schemata

Computer Applications

Artificial intelligence, graphics, picture and signal processing, modelling and simulation, numerical analysis, optimization

Computer Systems

Computer architecture, networks and distributed processing, computer communications, mini- and microcomputers

Within these areas, the program emphasizes problems of current practical significance and has close links to the scientific and industrial communities.

The Master of Computer Science program involves several departments at Carleton University and the University of Ottawa, and is a joint program offered by the two universities. Students may include courses from both universities in their programs, but they should apply to the university with which they expect the closer association. A student's program will be administered by the university at which he/she is enrolled, and he/she will be subject to the graduate regulations of that university.

At Carleton University, a student chooses to register in the School of Computer Science, or the Department of Mathematics and Statistics, or the Department of Systems and Computer Engineering.

At the University of Ottawa, the program is offered in the Department of Computer Science.

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program. Refer to the general section of this calendar for regulations governing the qualifying year.

Master of Computer Science

Admission Requirements

Applicants should have an honours bachelor's degree in computer science or equivalent, with at least high second-class standing. By *equivalent* is meant an honours degree in a program which includes at least six computer science full courses, two of which must be at the fourth-year level, as well as four full courses in mathematics, one of which must be at the third- or fourth-year level. These courses must include the topics indicated below:

Computer Science

Data structures/file management, operating systems, computer architecture, algorithm design and analysis, assembly language and two high-level languages

Mathematics

Calculus, linear algebra, algebraic structures or discrete mathematics, probability and statistics, numerical analysis

Program Requirements

Normally, students in the program will be expected to complete a thesis; however, students who have substantial relevant work experience may be permitted to take the non-thesis option, which must include a graduate research project course. Each candidate submitting a thesis will be required to undertake an oral defence of the thesis.

Students in the thesis option will take six half-courses or equivalent in addition to their thesis work. Students in the non-thesis option will take 10 half-courses. The course selections must be approved by the student's academic adviser, and must include at least

- One half-course in programming systems and languages

- One half-course in the theory of computing
- One half-course in either computer applications or computer systems.

Both course and thesis work may be completed either by full-time or part-time study. A candidate may be permitted to carry out thesis work off campus provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the committee.

Graduate Courses

The courses in the following list are offered by various departments indicated by the prefix of the course code as follows:

Carleton University

70. Department of Mathematics and Statistics
 94. Department of Systems and Computer Engineering
 95. School of Computer Science

University of Ottawa

- CSI Department of Computer Science
 ELG Department of Electrical Engineering
 MAT Department of Mathematics

Graduate courses at the University of Ottawa normally carry a weight of either two or three credits. A half-course at Carleton University is equivalent to a three-credit course at the University of Ottawa. Thus, for instance, three two-credit courses are counted towards program completion as two half-courses.

Programming Systems and Languages

- 94.480 Introduction to Software Engineering
 94.531 System Design with ADA
 94.571 Mini/Microcomputer Operating System Design
 94.573 Integrated Database Systems
 94.579 Advanced Topics in Software Engineering
 95.404 System Software
 95.490 Advanced Topics in Computer Science
 95.501 Foundations of Programming Languages
 95.502 End-User Facilities
 95.509 Design of Information Retrieval Systems
 CSI4110 Systems Programming
 CSI5110 Advanced Programming Principles
 CSI5115 Database Management Systems
 CSI5118 Compiler Design and Optimization
 ELG5185 Compiler Techniques

Theory of Computing

- 70.482 Introduction to Mathematical Logic
 70/95.483 Topics in Applied Logic
 70/95.484 Design and Analysis of Algorithms

- 70/95.485 Theory of Automata
 70.565 Theory of Automata
 70.585 Topics in Algorithm Design
 70/95.587 Formal Language and Syntax Analysis
 95.504 Topics in Arithmetic Complexity
 95.505 Automata Models of Learning Systems
 95.508 Computational Geometry
 CSI4101 Theory of Automata I
 CSI4102 Theory of Automata II
 CSI4105 Design and Analysis of Algorithms
 CSI5101 Formal Models of Computational Systems
 CSI5162 Topics in the Theory of Computing
 MAT5165 Algebraic Automata Theory I
 MAT5166 Algebraic Automata Theory II

Computer Applications

- 70/95.486 Numerical Analysis
 70.569 Topics in Combinatorial Mathematics
 70.581 Linear Optimization
 70.583 Nonlinear Optimization
 70.584 Topics in Operations Research
 70.585 Topics in Algorithm Design
 70.586 Numerical Analysis
 70.588 Combinatorial Optimization
 70.589 Combinatorial Optimization
 94.405 Discrete Simulation and its Applications
 94.501 Simulation and Modelling
 94.504 Computer Methods in Industrial Engineering
 94.505 Optimization Theory and Methods
 94/95.507 Expert Systems
 95.402 Computer Graphics
 95.403 Transaction Processing Systems
 95.407 Applied Artificial Intelligence
 95.590 Selected Topics in Computer Science
 95.506 Natural Language Processing
 CSI4120 Analog Computation
 CSI4121 Simulation Techniques for Continuous Systems
 CSI4122 Simulation of Discrete-Change Systems
 CSI4125 Foundations of Simulation
 CSI4133 Computer Methods in Picture Processing
 CSI4134 Pattern Recognition Techniques
 CSI4530 Graphiques Interactifs
 CSI5120 Simulation of Large-Scale Systems
 CSI5121 Hybrid Computer Problem Solving
 CSI5150 Numerical Optimization Methods
 CSI5161 Topics in System Simulation and Optimization
 CSI5384 Computer Graphics
 ELG5378 Image Processing Techniques
 MAT4236 Numerical Methods for Differential Equations
 MAT4381 Numerical Linear Algebra I
 MAT4382 Numerical Linear Algebra II

Computer Systems

- 94.457 Introduction to the Architecture of
Computer Systems
- 94.461 Microprocessor Systems
- 94.511 Computer System Design for Performance
- 94.519 Teletraffic Engineering
- 94.521 Computer Communication
- 94.527 Distributed Processing Systems
- 94.533 Digital Systems Engineering
- 94.534 Mini-Micro Applications
- 94.539 Advanced Topics in Digital Systems
Design
- 94.558 Digital Systems Architecture
- 94.576 Analytical Performance Models of
Computer Systems
- 94.577 Teleprocessing Software Design
- 95.503 Principles of Distributed Computing
- 97.587 Microprocessor Electronics
- CSI4114 Microprogramming and Machine
Architecture
- CSI4132 Real-Time and Data Communications
Systems
- CSI4331 Advanced Mini- and Microcomputer
Systems
- CSI5160 Topics in Mini- and Microcomputer
System
- ELG5189 Principles of Microprogramming
- ELG5190 Computer Architecture
- ELG5195 Principles of Microprocessors
- ELG5192 Microprocessor-Based Systems
- ELG5193 Multimicroprocessor Systems
- ELG5374 Computer Communication Networks
- ELG7182 Topics in Computer Architecture

Theses and Projects

- 70.591 Directed Studies
- 70.593 Project
- 94.596 Directed Studies
- 95.591 Directed Studies
- 95.592 Project
- 70/94/95.595 M.C.S. Thesis

Departmental

Program

Descriptions

and

Details

of

Courses

Faculty of Science

Dean: J.M. Neelin

The Centre

Director of the Centre: D.L. Brown

Associate Director: To be announced

Students wishing to pursue studies in biological sciences at the M.Sc. and Ph.D. levels in the Ottawa area do so in a co-operative program that combines the resources of the Departments of Biology of Carleton University and the University of Ottawa. The two universities have a joint committee supervising the programs, regulations, and student admissions.

Students are admitted for graduate work under the general regulations of the centre. Additional criteria for admission include academic performance, research experience, and referees' appraisals. The student must also be accepted by a faculty member who will supervise the research project, and the choice of supervisor will determine the primary campus location of the student. The student's advisory committee will normally include faculty members from both universities.

Requests for information, and completed applications should be sent to the director of the centre, or to the supervisor of graduate studies at either institution.

Members of the Centre

J.B. Armstrong, *Biochemical Genetics*

J.T. Arnason, *Plant Science*

C.A. Barlow, *Experimental Ecology*

I.L. Bayly, *Wetland Ecology*

Frédéric Briand, *Community Ecology*

D.L. Brown, *Cell Biology*

G.R. Carmody, *Population Genetics*

B.B. Dena, *Bacteriology*

J.R. Dillon, *Molecular Genetics*

M.B. Fenton, *Behavioural Ecology*

J.C. Fenwick, *Comparative Endocrinology*

D.R. Gardner, *Pesticide/Nerve Interactions*

Roy Greenhalgh, *Environmental Toxicology*

D.A. Hickey, *Population Genetics*

H.F. Howden, *Biogeography, Systematics of Insects*

André Hurst, *Microbiology*

W.I. Illman, *Fungal Systematics*

R.J. Ireland, *Plant Biochemistry*

V.N. Iyer, *Bacterial Genetics*

S.L. Jacobson, *Excitable Cell Physiology*

D.A. Johnson, *Molecular Biology*

K.W. Joy, *Plant Metabolism*

P.A. Keddy, *Plant Ecology*

W.A. Keller, *Plant Tissue Culture*

D.J. Kushner, *Microbiology*

J.D.H. Lambert, *Plant Communities and Man*

P.E. Lee, *Viral Ultrastructure*

L.R. Lefkovich, *Mathematical Biology*

E.E. Lindquist, *Mite Systematics*

D.E. McAllister, *Fish Systematics*

M.W. McBurney, *Developmental Biology*

M.E. McCully, *Plant Ultrastructure and Development*

John McNeill, *Plant Systematics*

H.G. Merriam, *Woodland Ecosystems*

T.W. Moon, *Comparative Physiology*

Pierre Moreau, *Cell Biology*

C.E. Morris, *Physiology of Excitable Cells*

J.M. Neelin, *Nuclear Proteins and Differentiation*

Constance Nozzolillo, *Plant Physiology, Phytochemistry*

D.D. Peakall, *Wildlife Toxicology*

S.B. Peck, *Arthropod and Beetle Evolution Systematics*

B.J.R. Philogène, *Ecophysiology of Insects*

Jaroslav Picman, *Behavioural Ecology*

S.U. Qadri, *Ichthyology*

R.W. Seagull, *Cytology, Ultrastructure*

V.L. Seligy, *Molecular Genetics*

George Setterfield, *Cell Differentiation, Ultrastructure*

John Sinclair, *Biophysics of Cells*

D.A. Smith, *Vertebrate Populations*

K.B. Storey, *Biochemical Adaptations*

Jean Vaillancourt, *Animal Ecology*

P.J. Weatherhead, *Behavioural Ecology*

J.A. Webb, *Plant Metabolism*

Pearl Weinberger, *Environmental Plant Physiology, Ecotoxicology*

Frank Wightman, *Metabolism of Plant Hormones*

D.M. Wood, *Dipteran Taxonomy*

Hiroshi Yamazaki, *Bacterial Metabolism, Biotechnology*

Ottawa-Carleton Graduate Specialization in Neuroscience

The Departments of Biology and Psychology at Carleton University, and the Departments of Anatomy, Physiology, and Psychology at the University of Ottawa provide a graduate specialization in neuroscience at the Ph.D. level (and, under special circumstances, at the M.Sc. or M.A. level). For further details see page 192.

Each campus is well equipped for a wide range of biological research; some major equipment and facilities include transmission and scanning elec-

tron microscopes, spectrophotometers, liquid scintillation and other radioactivity counters, high performance liquid and gas chromatographs, amino acid analyzer, preparative and analytical ultracentrifuges, electrophysiology equipment, animal and plant growth facilities, controlled environment cabinets, and on-line computer access. Students also benefit from the resources of nearby government laboratories and libraries (for example, Agriculture Canada, Environment Canada, Health and Welfare Canada, and the National Research Council).

Master of Science

Admission Requirements

An honours B.Sc. or equivalent degree at a standard acceptable to the two universities is required for admission to the M.Sc. program. Applicants with acceptable standing in a non-honours degree may be admitted to a qualifying-year program which will be determined in each case by the admissions committee.

Applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

Program Requirements

The M.Sc. degree will be conferred upon a candidate who has fulfilled the following requirements:

- Completion of the advanced courses specified by the admissions committee and the student's advisory committee; these will range from one to three full (two-term) courses, depending on the background and research program of the student. At least one course at the graduate level must be included, and not more than one course at the fourth-year honours level (completed while registered as a graduate student) may form part of the candidate's course requirements. The passing grade for all required courses is 70% or equivalent, and the student is not allowed a supplemental examination. Directed studies or reading courses may not make up more than half of the required number of courses. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement.
- Completion of at least two terms as a full-time student resident at one of the two universities is normally required. Programs for part-time students may be arranged.
- Presentation of one public seminar on the candidate's thesis research.

- Completion of a thesis incorporating the results or original research carried out under the direct supervision of an approved faculty member.
- Successful oral defence of the thesis before an examination board of at least three faculty members, normally drawn from both universities.

Doctor of Philosophy

Admission Requirements

An M.Sc. from a recognized university is usually required for entry to the Ph.D. program; however, an applicant with a first-class B.Sc. and excellent references may be admitted directly to the Ph.D. program. A student already registered for the M.Sc. may be permitted to transfer to the Ph.D. program following a recommendation by the departmental graduate committee and successful completion of the comprehensive examination required of Ph.D. candidates.

All applicants must demonstrate a fluent knowledge of English (Carleton), or either English or French (Ottawa).

Program Requirements

The Ph.D. degree will be conferred upon a candidate who has fulfilled the following requirements:

- Completion of the courses at the graduate level specified by the admissions and advisory committees; these will range from two to four full-courses (three to six courses if admitted without an M.Sc.), depending on the background and research program of the student. Only graduate courses may form part of the candidate's course requirements. The passing grade for all required courses is 70%, and the student is not allowed a supplemental examination. Directed studies or reading courses may not make up more than half of the required number of courses. The admissions committee or the student's advisory committee may also direct the student to take or to audit additional courses. Knowledge of a second language may be specified as a requirement.
- Completion of an oral comprehensive examination within approximately 12 months of entry into the program; this examination will cover the candidate's area of research, and general biology. The format of the examination will be established by the departmental graduate committee and approved by the admissions committee. The examination committee will generally be composed of faculty members of both universities.
- Presentation of at least one public seminar on the candidate's thesis research.

- A thesis incorporating the results of original research carried out under the direct supervision of an approved faculty member.
- Completion of at least four terms as a full-time student resident at one of the two universities (or six terms if admitted without an M.Sc.) is normally required. Under exceptional conditions programs may be arranged for part-time students.
- Successful oral defence of the thesis before an examination board of at least five faculty members, with representation from both universities, and including an external examiner from outside the two universities who is an authority on the thesis research area.

Graduate Courses*

The following courses are offered in the graduate program, but not all are available in any academic year. A list of the courses scheduled for the year is available from the centre in May.

- Biology 61.501F1 (BIO5101)
Topics in Regulation of Metabolism

- Biology 61.503F1 (BIO5103)
Biochemical Adaptations of Organisms to the Environment

- Biology 61.510T2 (BIO5201)
Advanced Plant Morphogenesis

- Biology 61.517T2 (BIO5202)
Molecular Genetics

- Biology 61.519T2 (BIO8219)
Evolutionary Genetics

- Biology 61.520T2 (BIO8238)
Techniques of Microscopy

- Biology 61.524T2 (BIO5203)
Developmental Cell Biology

- Biology 61.525T2 (BIO5204)
Plant Physiology and Metabolism

- Biology 61.535T2 (BIO5212)
Special Studies in Physiology

- Biology 61.536T2 (BIO9201)
Photobiology

- Biology 61.541F1 (BIO5104)
Mammalian Reproductive Biology

- Biology 61.542T2 (BIO8262)
Developmental Endocrinology/Topics in Comparative Endocrinology

- Biology 61.547T2 (BIO5205)
Quantitative Ecology

- Biology 61.548T2 (BIO9200)
Population Biology of Species and Communities/
Advanced Community and Population Ecology

- Biology 61.549T2 (BIO5206)
Mathematical Modelling for Biologists

- Biology 61.550T2 (BIO5207)
Selected Topics

- Biology 61.551F1 (BIO8100)
Advanced Topics/Selected Topics in Biology I

- Biology 61.552W1 (BIO8102)
Advanced Topics/Selected Topics in Biology II

- Biology 61.553T2 (BIO5001)
Recent Advances in Biology

- Biology 61.556T2 (BIO5213)
Advanced Insect/Animal Systematics

- Biology 61.557T2 (BIO5208)
Arachnology

- Biology 61.558T1 (BIO8137)
Principles and Practice of Biological Systematics

- Biology 61.565F1, W1, S1 (BIO5102)
Field Course

- Biology 61.570T2 (BIO5209)
Evolution and Biogeography

- Biology 61.575T2 (BIO5210)
Mammalogy

- Biology 61.581F1 (BIO5105)
Animal Behaviour

- Biology 61.590 (BIO8104)
Directed Special Studies and Research

- Biology 61.599F, W, S
M.Sc. Thesis

- Biology 61.600T2 (BIO8209)
Advanced Cell and Molecular Biology I

- Biology 61.620T2 (BIO8217)
Advanced Cell and Molecular Biology II

- Biology 61.621F1 (BIO8117)
Advanced Cell Biology I

- Biology 61.622W1 (BIO8118)
Advanced Cell Biology II

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Biology 61.625T2 (BIO8219)
Advanced Plant Physiology
- Biology 61.626T2 (BIO8237)
Advanced Experimental Technique
- Biology 61.627T2 (BIO8264)
Ion Channels
- Biology 61.630T2 (BIO8220)
Advanced Plant Biochemistry
- Biology 61.631F1 (BIO8121)
Advanced Microbial Physiology
- Biology 61.632F1 (BIO9103)
Topics in Cancer Research
- Biology 61.634F1 (BIO8361)
Advanced Topics in Animal Physiology
- Biology 61.636T2 (BIO8205S)
Graduate Seminars in Physiology
- Biology 61.637F1 (BIO8362)
Fish Physiology
- Biology 61.638F1 (BIO8363)
Evolution and Adaptation in Fish
- Biology 61.641F1 (BIO8135)
Topics in Plant Biology
- Biology 61.642F1 (BIO9101)
Environmental Toxicology
- Biology 61.643F1
Ecotoxicology
- Biology 61.644W1 (BIO8136)
Plant:Animal Interactions
- Biology 61.646W1 (BIO8105)
Current Topics in Community Ecology
- Biology 61.647T2 (BIO8204S)
Ecology Seminar
- Biology 61.651F1 (BIO8307)
Selected Topics in Molecular Biology
- Biology 61.660T2 (BIO8242)
Special Ichthyology I
- Biology 61.661T2 (BIO8243)
Special Ichthyology II
- Biology 61.680T2 (BIO8221)
Advanced Studies in Animal Behaviour
- Biology 61.699F, W, S
Ph.D. Thesis

The Institute

Director of the Institute: Tony Durst

Deputy Director of the Institute: J.A. Koningstein

The institute, established in 1981, represents the combined research strengths of Carleton University and the University of Ottawa. Research facilities are available on both campuses, and graduate students will conduct their research on the campus where the faculty members under whose supervision they have chosen to work maintain a laboratory. Programs leading to the degrees of M.Sc. and Ph.D. in most areas of chemistry are available.

Members of the Institute

Howard Alper, *Organometallic Chemistry*

J.W. ApSimon, *Natural Products Chemistry*

M.H. Back, *Chemical Kinetics and Photochemistry*

H.H. Baer, *Carbohydrate Chemistry*

R.G. Barradas, *Electrochemistry*

D.M. Bishop, *Theoretical Chemistry*

G.W. Buchanan, *Use of NMR Spectroscopy in*

Organic Problems

P.H. Buist, *Bio-organic Chemistry*

C.L. Chakrabarti, *Analytical Chemistry*

B.E. Conway, *Electrochemistry*

Christian Detellier, *Bio-inorganic Chemistry*

Tony Durst, *Synthetic and Medicinal Organic Chemistry*

R.R. Fraser, *Physical Organic Chemistry*

J.M.J. Frechet, *Organic Polymer Chemistry*

B.R. Hollebone, *Chemical Spectroscopy and Chemical Toxicology*

J.L. Holmes, *Mass Spectroscopy*

J.A. Koningstein, *Chemical Physics*

Peter Kruus, *Structure and Dynamics in Liquids and Solutions*

E.P.C. Lai, *Photoacoustic Spectroscopy, Analytical Chemistry*

K.J. Laidler, *Reaction Kinetics*

J.B. Milne, *Inorganic Chemistry*

Peter Morand, *Organic Chemistry*

B.A. Morrow, *Surface Chemistry and Catalysis*

J.-L.A. Roustan, *Bio-inorganic Chemistry*

J.J. Sloan, *Infrared Chemiluminescence*

I.C.P. Smith, *NMR Studies of Biologically Important Molecules*

Heshel Teitelbaum, *Gas Phase Reactions*

C.S. Tsai, *Enzyme Chemistry*

A.D. Westland, *Physical Inorganic Chemistry*

D.C. Wigfield, *Chemical Toxicology*

D.R. Wiles, *Radio-analytical Chemistry*

J.S. Wright, *Molecular Reaction Dynamics*

Master of Science

Admission Requirements

The normal requirement for admission to the program is an honours B.Sc. degree in Chemistry, with at least high second-class standing. Applicants who do not meet this requirement, or whose undergraduate degree is in another, closely related field, may be accepted into the program, but may be assigned extra courses.

Program Requirements

- A research thesis, which must be defended at an oral examination
- Two graduate courses (one semester each)
- One seminar course (two semesters)

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is a B.Sc. or an M.Sc. degree in Chemistry.

Program Requirements (from B.Sc.)

- A research thesis, to be defended before an examination board which will include an external examiner
- A comprehensive examination in chemistry; the format of this examination depends upon the field of chemistry in which the student is conducting his/her research
- Seven graduate courses (one semester each)
- Two seminar courses (two semesters each).

Program Requirements (from M.Sc.)

- As above, except that credit for up to two graduate courses may be given to reduce the requirement for graduate courses from seven to five.

Residence Requirements

For the M.Sc. degree:

- at least one year of full-time study.

For the Ph.D. degree (from B.Sc.):

- at least three years of full-time study.
For the Ph.D. degree (from the M.Sc.):
- at least two years of full-time study.

Graduate Courses

- Chemistry 65.509 (CHM8150)
Special Topics in Molecular Spectroscopy
- Chemistry 65.515 (CHM8110)
Algebraic Quantum Mechanics of Molecular Structure
- Chemistry 65.517 (CHM8161)
Physical Chemistry of Solutions
- Chemistry 65.519 (CHM8149)
Molecular Reaction Dynamics
- Chemistry 65.520 (CHM8152)
Surface Chemistry and Catalysis
- Chemistry 65.522 (CHM8131)
Electrochemistry I
- Chemistry 65.523 (CHM8141)
Electrochemistry II
- Chemistry 65.525 (CHM8129)
Chemistry of Natural Products
- Chemistry 65.526 (CHM8155)
Nucleic Acid Chemistry
- Chemistry 65.527 (CHM8121)
Organic Reaction Mechanisms
- Chemistry 65.528 (CHM8133)
Multinuclear Magnetic Resonance Spectroscopy
- Chemistry 65.532 (CHM8153)
Chemical Mechanisms of Biochemical Reactions
- Chemistry 65.540 (CHM8114)
Special Topics in Non-Metal Chemistry
- Chemistry 65.541 (CHM8117)
Organometallic Chemistry
- Chemistry 65.542 (CHM8115)
Special Topics in Inorganic Chemistry
- Chemistry 65.543 (CHM8112)
Methods in Analytical Chemistry
- Chemistry 65.544 (CHM8125)
Organic Synthesis
- Chemistry 65.545 (CHM8127)
Chemistry of Carbohydrates
- Chemistry 65.546 (CHM8128)
Specialty Polymers: An Organic Approach
- Chemistry 65.547 (CHM8134)
Spectroscopy for Organic Chemists
- Chemistry 65.548 (CHM8122)
Special Topics in Organic Chemistry
- Chemistry 65.549 (CHM8123)
Recent Advances in Organic Chemistry
- Chemistry 65.550 (CHM8116)
Analytical Instrumentation
- Chemistry 65.551T (CHM8220S)
Problems in Organic Chemistry
- Chemistry 65.555 (CHM8119)
Analytical Atomic Spectroscopy: Absorption
- Chemistry 65.556 (CHM8120)
Analytical Atomic Spectroscopy: Emission and Fluorescence
- Chemistry 65.561 (CHM8118)
Advanced Physical Inorganic Chemistry
- Chemistry 65.570 (CHM8151)
Electrochemistry III
- Chemistry 65.571 (CHM8145)
Photochemistry
- Chemistry 65.572 (CHM8135)
Theories of Reaction Rates
- Chemistry 65.573 (CHM8137)
Advanced Chemical Kinetics
- Chemistry 65.574 (CHM8142)
Symmetry in Chemistry
- Chemistry 65.575 (CHM8140)
Chemical Spectroscopy
- Chemistry 65.576 (CHM8148)
Gas Phase Ion Chemistry
- Chemistry 65.577 (CHM8138)
Enzyme Kinetics and Mechanisms
- Chemistry 65.578 (CHM8156)
Chemical Toxicology I
- Chemistry 65.579 (CHM8157)
Chemical Toxicology II
- Chemistry 65.581T (CHM8256S)
Seminar I†
- Chemistry 65.582T (CHM8257S)
Seminar II†

*Courses offered in the fall and winter (or any other two terms) will be followed by T.

†Full-course credit; graded satisfactory/unsatisfactory.

- Chemistry 65.583T (CHM8258S)

Seminar III†

- Chemistry 65.584 (CHM8143)

Selected Topics in Physical Chemistry

- Chemistry 65.590 (CHM8158)

Directed Special Studies

- Chemistry 65.599 (CHM7999)

M.Sc. Thesis

- Chemistry 65.699 (CHM9999)

Ph.D. Thesis

The Ottawa-Carleton Centre for Geoscience Studies

The Centre

The centre, established in 1982, represents the combined research strengths of Carleton University and the University of Ottawa. Research facilities are shared between the two campuses and graduate students are enrolled in the university where their faculty supervisors hold appointments. Programs are available leading to the degrees of M.Sc. and Ph.D. in most areas of geoscience. Four areas of research are emphasized, each involving a major component of field work: Precambrian geology, structural geology and geodynamics, Arctic studies, and resource geology. The Derry Laboratory for Sedimentary Geochemistry and Mineral Deposits and the Geotechnical Science Laboratories are research units in the centre.

All thesis, seminar and examination requirements in the centre may be met either in French or English. Courses are offered in French wherever appropriate.

Members of the Centre

F.P. Agterberg, *Geomathematics*

A.J. Baer, *Proterozoic Orogenies; Grenville Province*

Keith Bell, *Isotope Studies; Petrology; Geochronology*

John Blenkinsop, *Mass Spectrometry; Geochronology*

A.C. Brown, *Sedimentary Ore Deposits*

R.L. Brown, *Structural Geology; Cordilleran Tectonics*

E.M. Cameron, *Sedimentary Geochemistry and Mineral Deposits; Exploration Geochemistry*

G.Y. Chao, *Mineralogy; Crystallography*

Ersen Çogulu, *Igneous Petrology; Ophiolites*

J.A. Donaldson, *Precambrian Stratigraphy and Sedimentology*

O.A. Dixon, *Invertebrate Paleontology; Stratigraphy; Canadian Arctic*

H.M. French, *Permafrost and Periglacial Phenomena*

J.M. Franklin, *Ore Deposits; Hydrothermal Alteration*

Edgar Froese, *Metamorphic Petrology; Thermodynamics*

W.K. Fyson, *Structural Analyses in Metamorphic Terrains*

M.-A. Geurts, *Contemporary and Quaternary Palynology*

S.K. Hanmer, *Structural Geology; Progressive Strain; Microstructure*

Keiko Hattori, *Ore Deposits; Stable Isotope Geochemistry*

D.D. Hogarth, *Mineralogy; Igneous and Metamorphic Petrology; Alkaline Rocks*

Kenneth Hooper, *Paleontology; Foraminifera*

J.P. Johnson, *Glacial & Periglacial Geomorphology;*

Glaciology; Remote Sensing; Quaternary Geology

P.G. Johnson, *Glacial Geomorphology; Slope Mass Movements, Glacier Hydrology*

I.R. Jonasson, *Geochemistry; Ore Deposits*

Ralph Kretz, *Petrology and Geochemistry of Metamorphic Rocks*

Jarmila Kukalova-Peck, *Paleontology; Fossil Insects*

M.B. Lambert, *Volcanology; Petrology of Volcanic Rocks*

D.J. McLaren, *Geological Time; Event Stratigraphy*

F.A. Michel, *Isotope Geochemistry; Groundwater in Permafrost and Geothermal Regions*

J.M. Moore, *Metamorphic Petrology; Volcanology; Precambrian Geology*

G.S. Nowlan, *Biostratigraphy; Paleocology; Precambrian and Lower Paleozoic Conodonts, Problematica*

C.R. Pride, *Geochemistry of Granites, Migmatites; Basalt Alteration*

Giorgio Ranalli, *Rheology of the Earth;*

Geodynamics; Plate Tectonics

B.R. Rust, *Clastic Sedimentology (Recent and Ancient); Coal Basins*

D.F. Sangster, *Metallic Mineral Deposits; Geochemistry*

G.B. Skippen, *Metamorphic Petrology; Experimental Petrology; Aqueous Geochemistry*

D.A. St-Onge, *Quaternary Stratigraphy, Regional Mapping; Glacial Landforms; Subarctic Regions*

M.W. Smith, *Permafrost, Microclimate, Soil Freezing*

J.K. Torrance, *Soil Chemistry and Geotechnical Properties*

Jan Veizer, *Sedimentary Geochemistry; Carbonates; Diagenesis; Ores; Precambrian Sedimentology*

D.H. Watkinson, *Metallic Mineral Deposits*

P.J. Williams, *Soil Freezing and Geotechnical Problems*

R.W. Yole, *Stratigraphy and Sedimentology; Petroleum Geology*

Visiting Scientists (1984-85)

Michael Bikerman, (Pittsburgh), *Isotope Geochemistry*

Brian Lowes, (Pacific Lutheran), *Cordilleran Geology*

Research Associate

J.W. Card, *Radon and Radon Decay Products*

Postdoctoral Fellows

J.M. Journeay, *Structural Geology; Cordilleran Tectonics*

W.S. Kim, *Ore Mineralogy*

A.D. Paktunç, *Igneous Petrology*

Master of Science

Admission Requirements

The normal requirement for admission to the program is an honours B.Sc. degree, with at least high second-class standing, in geology or a related discipline.

Program Requirements

- A research thesis, which will be defended at an oral examination
- Two graduate full courses
- Participation in the geoscience seminar series.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is an M.Sc. degree in geology or a related discipline. Students who show outstanding academic performance and research promise while in the M.Sc. program may be permitted to transfer to the Ph.D. program without completing the M.Sc.

Program Requirements

- A research thesis, to be defended orally before an examination board which will include an external examiner
- A comprehensive examination, with emphasis on areas chosen by the student's advisory committee
- Two graduate full courses
- Participation in the geoscience seminar series.

Residence Requirement

The normal residence requirement for the Ph.D. degree is at least four terms of full-time study.

Graduate Courses*

- Geology 67.511 (GEO5111)

Crystallography

Principles and techniques of X-ray crystallography; interpretation of X-ray photographs and application to the study of minerals.

G.Y. Chao.

- Geology 67.512 (GEO5112)

Rock-Forming Minerals

Recent work on structure, chemistry and interrelationships of igneous and metamorphic rock-forming minerals.

D.D. Hogarth.

- Geology 67.521 (GEO5121)

Igneous Petrogenesis

Concentration on one or more of: origin and differentiation of basaltic magma; origin of granites; computer modelling of partial melting and fractional crystallization; magmatism in time and space. Laboratory and lecture material linked together in project form.

(Also offered as GEO5721)

C.R. Pride.

- Geology 67.521 (GEO5721)

Pétrogenèse Ignée

Un cours basé sur un (ou plusieurs) des thèmes suivants: origine et différenciation de magma basaltique; origine de granites; simulation par ordinateur de fusion partielle et cristallisation fractionnée; magmatisme en temps et en espace. Laboratoire et cours qui s'enchainent sous forme d'un projet.

C.R. Pride.

- Geology 67.522 (GEO5122)

Physical Volcanology

The distribution, classification and physical characteristics of volcanos and other volcanic landforms; lava flows, tephra, breccias and other rocks formed through volcanic activity. Volcanic environments; recognition of ancient volcanic features; case histories.

M.B. Lambert.

*Half-courses. Not all courses are offered in any one calendar year; equal numbers of courses are offered annually at both campuses.

● **Geology 67.523 (GEO5123)**

Metamorphic Petrology

Thermodynamics and kinetics of mineral reactions; metamorphic zones and isograds; mass transfer; regional and global aspects of metamorphism.

Ralph Kretz, J.M. Moore.

● **Geology 67.524 (GEO5124)**

Metallic Mineral Deposits

Relationships of some metallic mineral deposits to igneous rocks: topics range from oxides and sulfides in and around intrusions to stratiform volcanogenic deposits. Course concludes with a field trip to northern Ontario and Quebec at end of winter term.

D.H. Watkinson, Keiko Hattori.

● **Geology 67.525 (GEO5125)**

Sedimentary Mineral Deposits

Mineral deposits of sedimentary affiliation, including those of iron, phosphorite, Mississippi Valley-type lead-zinc, sandstone-hosted base metals and uranium, sedimentary exhalative base metal, manganese, barite, and Kupferschiefer-type copper. Particular emphasis on the interrelationships among these deposits, their metallogenic characteristics and their control by earth evolutionary processes.

D.F. Sangster, A.C. Brown.

● **Geology 67.531 (GEO5131)**

Sedimentology and Stratigraphy

Selected problems in sedimentary geology, emphasizing sedimentary structures, facies models and diagenesis. The application of modern techniques of stratigraphic, petrologic and statistical analysis.

J.A. Donaldson, B.R. Rust.

● **Geology 67.532 (GEO5132)**

Paleoecology

Emphasis on marine fossils as paleoenvironmental indicators: effects of substrate type, energy conditions, light, temperature, biotic associates and other environmental factors on the occurrence and distribution of organisms and their fossil remains.

O.A. Dixon.

● **Geology 67.533 (GEO5133)**

Micropaleontology

The morphology of the main groups of microfossils, their importance to biostratigraphy, paleoecology and depositional environments. Identification of useful genera and species.

Kenneth Hooper.

● **Geology 67.534 (GEO5134)**

Fossil Fuels

Petroleum, natural gas, coal and unconventional fossil fuels; their origin, occurrence, and evaluation in the light of current geological thought.

R.W. Yole.

● **Geology 67.541 (GEO5141)**

Permafrost Hydrology and Investigative Methods

An examination of groundwater flow in permafrost regions. The importance of groundwater in the formation of various types of ground ice, and the effect of groundwater flow on permafrost distribution.

F.A. Michel.

● **Geology 67.551 (GEO5151)**

Precambrian Geology

Problems of Precambrian geology, emphasizing classical and current studies in North America; comparative study of the Canadian Shield and other Precambrian shields; research projects, field trips and petrologic studies of representative rock suites.

J.A. Donaldson.

● **Geology 67.552 (GEO5152)**

Geology of Arctic Canada

Origins and development of the principal geological regions of the Canadian Arctic. Emphasis on the Phanerozoic record but other topics or problems may be included.

O.A. Dixon.

● **Geology 67.561 (GEO5161)**

Low-Temperature Geochemistry

Geochemistry of sedimentary rocks and geochemical cycles; geochemical facies analysis, behaviour of elements and isotopes during sedimentation, diagenesis and epigenesis; geochemical evolution of sedimentary rocks during geologic history.

Keiko Hattori, Jan Veizer.

● **Geology 67.562 (GEO5162)**

Physical Geochemistry

Application of thermodynamics to geologic problems. Experimental study of mineral equilibria.

G.B. Skippen.

● **Geology 67.563 (GEO5163)**

Stable Isotope Geochemistry

Mechanisms of isotope fractionation in nature; physical and chemical isotope fractionation, kinetic isotope effects. Variations of stable isotope ratios (hydrogen, carbon, oxygen and sulphur) in nature. Preparation techniques of natural samples for isotope analysis. Applications of stable isotopes to study magma genesis, ore genesis, nature of water and formation fluids and sedimentary environments.

Keiko Hattori.

● **Geology 67.564 (GEO5164)**

Basin Evolution and Mineralization

Classification of sedimentary basins, tectonism and subsidence, P-T evolution, compaction and porosity development, hydrology, diagenesis, oil generation

and migration, evolution of brines, transport of ore constituents, traps, evolution of mineralization through time.

Jan Veizer.

● Geology 67.565 (GEO5165)

Radioisotope Geochemistry

Nucleosynthesis; chemical differentiation of the earth. Evolution of large scale reservoirs. Isotopic tracers ($^{143}\text{Nd}/^{144}\text{Nd}$, $^{87}\text{Sr}/^{86}\text{Sr}$, common Pb). Geochronology: fundamentals and application of Sm/Nd, Rb/Sr, U/Pb, K/Ar and Lu/Hf methods. Evolution of the solid earth from the isotopic perspective. Keith Bell.

● Geology 67.566 (GEO5166)

Exploration Geochemistry

Selected topics in applied geochemistry including: biogeochemical exploration; element mobilities in the surface environment; recent developments in data interpretation; quality control of geochemical data. Special attention to the use of geochemical methods for gold exploration and possible applications of stable and radiogenic isotopes to mineral exploration.

E.M. Cameron.

● Geology 67.571 (GEO5171)

Physics of the Earth

The physics and dynamics of the solid earth: seismology; gravitational and magnetic fields; thermal state. Geophysical constraints on the structure and composition of the interior. Geodynamic processes.

Giorgio Ranalli.

● Geology 67.572 (GEO5172)

Tectonophysics

The physics of deformation: continuum mechanics approach (elasticity, strength, plasticity, viscosity), and microrheological approach (diffusion, dislocations, and flow mechanisms). Applications to tectonic processes.

Giorgio Ranalli.

● Geology 67.573 (GEO5173)

Structural Geology

Selected problems in structural geology treated in seminar and laboratory sessions. Emphasis on the interpretation of fabrics developed during syn-metamorphic strain. Students investigate and report on individual projects.

R.L. Brown, W.K. Fyson.

● Geology 67.574 (GEO5174)

Tectonics

An investigation of the structural style of mountain belts and their tectonic setting; tectonics of Precambrian deformed belts.

R.L. Brown, W.K. Fyson.

● Geology 67.590, 67.591 (GEO5190, 5191)

Directed Studies

Directed reading and/or laboratory studies for full- or half-course credit, under the guidance of selected extramural or intramural directors.

● Geology 67.592 (GEO5292)

Topics in Geoscience

A half course given during fall and winter terms. Normally six modules are offered, each covering a major discipline of geoscience, from which the student selects four. Each module comprises four weeks of lectures, laboratory and/or problem sessions, and is in intensive short course in the discipline. The student will give a seminar in at least one module. The course is intended to provide broad background, to a level appropriate to the current state of knowledge in the discipline, but not to supplant more specialized courses in the graduate program. Modules will vary from year to year and be set the preceding spring.

● Geology 67.593 (GEO5193)

Field Studies

Systematic investigations of geological problems, based on a minimum of 15 days field work plus related library research and laboratory projects. Written report required.

● Geology 67.594 (GEO5294)

Problems in Historical Geology and Geological Time

Controversial ideas concerning the earth and time; historical development of thought on the physical and biological evolution of the earth. Understanding the stratigraphic column in regard to duration, age and correlation, including evidence from paleontology and sedimentology, particularly gaps in the succession and rhythmic or episodic events. Origin and nature of life; relationship between crustal events and evolution, including extinctions. Concepts and models in geology; responsibility of the geologist to humanity. Half course given during fall and winter terms.

D.J. McLaren.

● Geology 67.599 (GEO7999)

M.Sc. Thesis

● Geology 67.699 (GEO9999)

Ph.D. Thesis

In addition, the following courses in the Department of Geography are recommended:

- Geography 45.530W1

Soil Thermal and Hydrologic Regimes

Characteristics of soil regimes, particularly in freezing soils; role of soil properties; analytical and numerical methods, including computer simulation.

M.W. Smith.

- Geography 45.532F1

Soil Thermal and Hydrologic Properties

Instrumental techniques for investigation of hydrological and thermal processes near the earth's surface; laboratory instrumentation and analysis of laboratory and field procedures in geotechnical science.

P.J. Williams.

- Geography 45.533W1

Periglacial Geomorphology

Permafrost, its distribution and significance, seasonal ground freezing, ground thermal regime, physical, thermodynamic, and geotechnical properties of freezing and thawing soils, terrain features ascribable to frost action, and solifluction and patterned ground.

P.J. Williams.

- Geography 45.534W1

Aspects of Clay Mineralogy and Soil Chemistry

The role of clay minerals in soils will be considered from a geotechnical and/or biological perspective.

J.K. Torrance.

Graduate courses are also offered by the Department of Geography at University of Ottawa, in seminar format, with choice of topics to be determined by instructor and students at the beginning of term.

The Committee

Chairman of the Committee: S.A. Mahmoud

With the co-operation of the Department of Mathematics and Statistics and the Department of Systems and Computer Engineering, the committee offers programs of graduate study and research leading to the degree of Master of Science.

Within the program, four areas of specialization exist:

- Information Systems Engineering
- Numerical and Non-Numerical Applications of Computers
- Computer Science
- Mathematical Systems Theory and Applications

Combining elements from the disciplines of mathematics, statistics, systems engineering, computer science, and electrical engineering, the program is oriented towards the high-level theorist/practitioner who is called upon to examine systems-related problems, frequently of an interdisciplinary nature. Topics spanned by the four areas above include computer network design, mini/micro-computer systems, database systems, software development, theory of algorithms, dynamical systems, statistics, and operations research. Close links are maintained with the scientific, industrial, and technological communities, and an effort is made to direct students to project work of current practical significance.

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program. Refer to the general section of this calendar for regulations governing the qualifying year.

Master of Science

Admission Requirements

Applicants should have an honours bachelor's degree, or equivalent, with at least high second-class standing, in mathematics, engineering, physics, chemistry, computer science, operations research, experimental psychology, econometrics, management science, or a related discipline. Undergraduate preparation should include at least two full courses in computing and a minimum of three full courses in mathematics, at least one of which is at the third-year level or higher. In addition, the student is required to have some knowledge of quantitative applications, such as numerical analysis, simulation, operations research, etc.

Admissions to the program will be made through one of the two participating departments. Since space and laboratory facilities will be provided by one of the departments, students should apply through the department with which they wish to be most closely associated.

Program Requirements

The normal program comprises eight half-courses and a thesis having a weight of 1½ full courses; additional requirements may also be stipulated, depending upon the individual student's background. With the approval of the committee, students who have substantial work experience may be permitted to substitute three additional half-courses in place of the thesis, one of which must be a graduate project course.

Students must take at least one full course from each of the two participating departments as well as the joint course 70/94.582: Topics in Information Science. Each student should consult with his faculty adviser in the selection of a course pattern related to his principal area of interest.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of his/her thesis.

Course work may be completed on either a full-time or part-time basis. Thesis research normally requires full-time residence at the University; however, a candidate may be permitted to carry out thesis work off campus provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the committee.

Graduate Courses*

• Information and Systems Science 70/94.582W1 Topics in Information and Systems Science

The purpose of this course is to bring together fundamental results in the new and active area of design and analysis of efficient computer algorithms for large, complex problems. Areas of application include data manipulation, computer networks, queueing systems, and optimization.

• Information and Systems Science 70/94.598F3, W3, S3

M.Sc. Thesis in Information and Systems Science

Mathematics and Statistics

Undergraduate Courses:

- 70.301 Real Analysis I
- 70.302 Real Analysis II
- 70.310 Modern Algebra
- 70.350 Mathematical Statistics
- 70.403 Functional Analysis
- 70.451 Probability Theory
- 70.452 Sampling Theory and Methods I
- 70.453 Applied Multivariate Analysis
- 70.456 Non-Parametric Methods I
- 70.457 Statistical Inference
- 70.458 Stochastic Models
- 70.459 Stochastic Optimization
- 70.470 Partial Differential Equations I
- 70.471 Partial Differential Equations II
- 70.473 Qualitative Theory of Ordinary Differential Equations

70.482 Introduction to Mathematical Logic

70.483 Topics in Applied Logic

70.485 Theory of Automata

70.486 Numerical Analysis

70.487 Game Theory

70.496 Directed Studies

Graduate Courses:

- 70.507 Real Analysis I
- 70.508 Real Analysis II
- 70.510 General Algebra
- 70.517 Algebra I
- 70.519 Algebra II
- 70.552 Sampling Theory and Methods
- 70.553 Analysis of Variance
- 70.554 Stochastic Processes and Time Series Analysis

- 70.555 Design of Experiments
- 70.556 Robust Statistical Inference
- 70.557 Statistical Inference
- 70.558 Topics in Stochastic Processes
- 70.559 Multivariate Analysis
- 70.561 Stochastic Optimization
- 70.565 Theory of Automata
- 70.567 Game Theory
- 70.569 Topics in Combinatorial Mathematics
- 70.570 Probability Theory
- 70.571 Stochastic Models
- 70.581 Linear Optimization
- 70.583 Nonlinear Optimization
- 70.584 Topics in Operations Research
- 70.585 Topics in Algorithm Design
- 70.586 Numerical Analysis
- 70/95.587 Formal Language and Syntax Analysis
- 70.588 Combinatorial Optimization
- 70.589 Combinatorial Optimization
- 70.590 Seminar
- 70.591 Directed Studies
- 70.593 Project
- 70.652 Advanced Design of Surveys

Systems and Computer Engineering

Undergraduate courses:

- 94.303 Real-Time Computing Systems
- 94.367 Switching Circuits
- 94.401 Operating Systems
- 94.405 Discrete Simulation and its Applications
- 94.433 Advanced Real-Time Programming
- 94.445 Discrete Time Systems
- 94.451 Communication Systems
- 94.457 Introduction to the Architecture of Computer Systems
- 94.460 Data Communications
- 94.461 Microprocessor Systems
- 94.480 Software Engineering
- 94.481 Software Engineering Project
- 94.485 Computer Systems Design Laboratory

Graduate Courses:

- 94.501 Simulation and Modelling
- 94.504 Computer Methods in Industrial Engineering
- 94.505 Optimization Theory and Methods
- 94.507 Expert Systems
- 94.511 Computer System Design for Performance
- 94.517 Queueing, Scheduling and Control of Information Systems
- 94.518 Topics in Information Systems
- 94.519 Teletraffic Engineering
- 94.521 Computer Communication
- 94.527 Distributed Processing Systems
- 94.531 System Design with ADA
- 94.532 Systems Engineering Using VLSI Components

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following* the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- 94.533 Digital Systems Engineering
- 94.534 Mini-Micro Applications
- 94.539 Advanced Topics in Digital Systems Design
- 94.540 Topics in Office Automation
- 94.552 Advanced Linear Systems
- 94.553 Stochastic Processes
- 94.554 Principles of Digital Communication
- 94.557 Fundamentals of Discrete Systems
- 94.558 Digital Systems Architecture
- 94.562 Digital Signal Processing: Algorithms, Hardware and Software
- 94.565 Advanced Digital Communication
- 94.566 Multi-Access Communications Systems
- 94.567 Source Coding and Data Compression
- 94.568 Mobile Communications Systems
- 94.569 Digital Television: Coding and Compression
- 94.571 Mini/Microcomputer Operating System Design
- 94.573 Integrated Database Systems
- 94.574 Elements of Computer Systems
- 94.576 Analytical Performance Models of Computer Systems
- 94.577 Teleprocessing Software Design
- 94.579 Advanced Topics in Software Engineering
- 94.584 Advanced Topics in Communications Systems
- 94.589 Advanced Topics in Measurements and Models
- 94.596 Directed Studies

School of Computer Science

Undergraduate Courses:

- 95.402 Computer Graphics
- 95.403 Transaction Processing Systems
- 95.404 System Software
- 95.407 Applied Artificial Intelligence
- 95.490 Advanced Topics in Computer Science

Because of the interdisciplinary nature of this area, a student will in some cases benefit by taking a third-year course as part of his/her program. In such cases it will be extra to the formal degree requirements, or else arrangements will be made to ensure that the subject matter is enriched through extra reading, etc.

Institute for Graduate Studies and Research in Mathematics and Statistics

The Institute

Director of the Institute: J.D. Dixon

Associate Director: Mayer Alvo

Students who wish to pursue studies in pure mathematics, applied mathematics, probability and statistics at the graduate level leading to an M.Sc. or a Ph.D. degree can do so in a joint program offered by the Department of Mathematics and Statistics at Carleton University and the Department of Mathematics at the University of Ottawa under the auspices of the Institute for Graduate Studies and Research in Mathematics and Statistics. The institute is responsible for supervising the programs, regulations and student admissions, as well as providing a framework for interaction between the two departments at the research level.

The principal research interests of members of the institute include the following fields:

Pure Mathematics

Analytic inequalities, category theory, differential equations, fixed-point theory, functional analysis, generalized functions, geometry, group theory, harmonic analysis, homological algebra, Jordan algebras, number theory, representations of algebras, representations of Lie groups, ring theory, topology

Applied Mathematics

Applied analysis, analysis of algorithms, automata theory, coding theory, combinatorial optimization, control theory, numerical analysis, operations research, special functions

Probability and Statistics

Estimation theory, experimental design, foundations of statistical inference, invariance principles, multivariate analysis, probability in Banach spaces, sampling theory, sequential analysis, statistical methods, stochastic processes.

In addition to the programs administered by the institute, the Department of Mathematics and Statistics at Carleton University offers several other programs.

In co-operation with the Department of Systems and Computer Engineering at Carleton University, students may pursue a program leading to an M.Sc. in Information and Systems Science; for information see page 135.

In co-operation with the School of Computer Science and the Department of Systems and Computer Engineering at Carleton University and the Department of Computer Science at the University

of Ottawa, students may pursue a program leading to a Master of Computer Science (M.C.S.); for information see page 117.

The Department of Mathematics and Statistics also offers a co-operative master's program in statistics in collaboration with the federal government, emphasizing practical training through work experience, along with sound training in statistical inference and basic probability theory; for further information contact the department directly.

Master of Science

Admission Requirements

The normal requirement for admission to the master's program is an honours bachelor's degree in mathematics, or the equivalent, with at least high second-class standing. Applicants holding a general (pass) degree with at least high second-class standing may be admitted to a qualifying-year program. Their subsequent admission to the regular master's program depends on their performance during the qualifying-year program and will be decided no later than one year after admission to the qualifying-year program. Details are outlined in the general section of this calendar.

Program Requirements

The two options for the M.Sc. program are:

- Eight one-term courses (or equivalent) and a thesis
- Ten one-term courses (or equivalent).

The courses must be chosen from those at the graduate level except that a student may take up to two one-term approved undergraduate courses at the fourth-year level to satisfy these requirements. Not all these courses may be taken in the same field of mathematics; at least two must be in another field. All master's students are required to participate actively in a seminar or project under the guidance of his/her adviser. A maximum of two one-term courses taken outside of the Department of Mathematics and Statistics at Carleton University or the Department of Mathematics at the University of Ottawa may be allowed for credit.

Students who plan to specialize in probability and statistics are strongly advised that during their master's program they include, where possible, the courses 70.450, 70.551 in mathematical statistics; 70.452, 70.555 in applied statistics, and 70.451, 70.571 in probability, together with two further

one-term courses in the Department of Mathematics and Statistics. In addition, a graduate course in another field, such as biology, biostatistics, economics, computer science, systems analysis, and stochastic modelling, is highly recommended.

Doctor of Philosophy

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree in mathematics, or the equivalent, with at least high second-class standing. Details are outlined in the general section of this calendar.

Program Requirements

The course requirements, which are determined at the time of admission, include a minimum of six one-term graduate courses (or equivalent) and a suitable thesis. Not all of these courses may be taken in the same field of mathematics; at least two must be in another field.

All candidates must take a comprehensive examination, and satisfy a language requirement. The language requirement is determined by the candidate's advisory committee and normally requires the ability to read mathematical literature in a language considered useful for his/her research or career, and other than the candidate's principal language of study.

A comprehensive examination will be undertaken in the following areas:

- The candidate's general area of specialization at the Ph.D. level
- A basic examination on two topics chosen from algebra, analysis, probability, and topology. (This choice excludes the student's specialty.)

This examination must be completed successfully within 18 months of initial registration into the Ph.D. program in the case of a full-time student, and within 36 months of initial registration in the case of a part-time student.

All Ph.D. candidates are also required to undertake a final oral examination on the subject of their thesis.

Selection of Courses

The following undergraduate courses may, with the approval of the department of Mathematics and Statistics, be selected by master's candidates in partial fulfilment of their degree requirements:

Mathematics and Statistics

- 70.401 Vector Calculus
- 70.403 Functional Analysis
- 70.407 Measure Theory
- 70.415 Rings and Modules
- 70.416 Group Theory
- 70.417 Commutative Algebra
- 70.418 Homological Algebra and Category Theory
- 70.425 Introduction to General Topology
- 70.426 Introduction to Algebraic Topology
- 70.427 Foundations of Geometry
- 70.428 Introduction to Differentiable Manifolds
- 70.435 Analytic Number Theory
- 70.436 Algebraic Number Theory
- 70.445 Analytical Dynamics
- 70.446 Hydrodynamics and Elasticity
- 70.447 Tensor Analysis and Relativity Theory
- 70.450 Parametric Estimation
- 70.451 Probability Theory
- 70.452 Sampling: Theory and Methods I
- 70.453 Applied Multivariate Analysis
- 70.456 Non-Parametric Methods
- 70.457 Statistical Inference
- 70.458 Stochastic Models
- 70.459 Stochastic Optimization
- 70.470 Partial Differential Equations I
- 70.471 Partial Differential Equations II
- 70.472 Integral Transforms
- 70.473 Qualitative Theory of Ordinary Differential Equations
- 70.482 Introduction to Mathematical Logic
- 70.483 Topics in Applied Logic
- 70.484 Design and Analysis of Algorithms
- 70.485 Theory of Automata
- 70.486 Numerical Analysis
- 70.487 Game Theory

Graduate Courses*

- Mathematics 70.501W1 (MAT5120)
Abstract Measure Theory
Abstract measure and integral, L-spaces, complex measures, product measures, differentiation theory, Fourier transforms.
Prerequisite: Mathematics 70.407.
J.N. Pandey and L.D. Nel.

*F,W,S indicates term of offering.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Mathematics 70.502F1 (MAT5123)
Distributions and Generalized Functions
Linear topological spaces, countably multinormed spaces, countable union spaces and their duals, testing function spaces, spaces of generalized functions and their structure, Schwartz distributions, calculus of distribution, convolution, analytic representation, and Fourier transform of distributions.

Prerequisite: Mathematics 70.403.

J.N. Pandey.

- Mathematics 70.503F1 (MAT5122)
Banach Algebras
Commutative Banach algebras; the space of maximal ideals; representation of Banach algebras as function algebras and as operator algebras; the spectrum of an element; special types of Banach algebras: for example, regular algebras, algebras with involution; applications.
L.D. Nel.

- Mathematics 70.504W1 (MAT5129)
Integral Equations
A survey of the main results in the theory of non-singular linear integral equations; Volterra and Fredholm equations of first and second kind in the L_2 case, with special results for the continuous case; Hermitian kernels; eigen-function expansions; compact operators.

Prerequisites: Mathematics 70.302 and 70.403.

P.R. Beesack.

- Mathematics 70.505F1 (MAT5127)
Complex Analysis
Complex differentiation and integration, harmonic functions, maximum modulus principle, Runge's theorem, conformal mapping, entire and meromorphic functions, analytic continuation.
Arthur Smith.

- Mathematics 70.507F1 (MAT5125)
Real Analysis I
General measure and integral, Lebesgue measure and integration on \mathbb{R} , Fubini's theorem, Lebesgue-Radon-Nikodym theorem, absolute continuity and differentiation, L^p -spaces. Selected topics such as: Daniell-Stone theory.

Prerequisites: Mathematics 70.301 and 70.302 (MAT3125) or permission of the department.

- Mathematics 70.508W1 (MAT5126)
Real Analysis II
Banach and Hilbert spaces, bounded linear operators, dual spaces. Topics selected from: weak- and weak*- topologies, Alaoglu's theorem, compact operators, differential calculus in Banach spaces, Riesz representation theorems.

Prerequisite: Mathematics 70.507 (MAT5125) or permission of the department.

- Mathematics 70.509F1 (MAT5121)
Introduction to Hilbert Space
Geometry of Hilbert Space, spectral theory of linear operators in Hilbert Space.

Prerequisites: Mathematics 70.301, 70.302, and 70.403.

J.N. Pandey.

- Mathematics 70.512F1 (MAT5148)
Group Representations and Applications
An introduction to group representations and character theory, with selected applications.
B.M. Puttaswamaiah.

- Mathematics 70.513F1 (MAT5146)
Rings and Modules
Generalizations of the Wedderburn-Artin theorem and applications, homological algebra.
Maurice Chacron, Vlastimil Dlab, and B.M. Puttaswamaiah.

- Mathematics 70.514F1 (MAT5143)
Lie Algebras
Basic concepts: ideals, homomorphisms, nilpotent, solvable, semi-simple. Representations, universal enveloping algebra. Semi-simple Lie algebras: structure theory, classification, representation theory.

Prerequisites: Mathematics 70.517 (MAT5141) and 70.519 (MAT5142) or permission of the department.

- Mathematics 70.516W1 (MAT5145)
Group Theory
Fundamental principles as applied to abelian, nilpotent, solvable, free, and finite groups; representations.
Prerequisite: Mathematics 70.310 or permission of the department.
Luis Ribes, B.M. Puttaswamaiah, J.D. Dixon, and J.C. Poland.

- Mathematics 70.517F1 (MAT5141)
Algebra I
Groups, Sylow subgroups, finitely generated abelian groups. Rings, field of fractions, principal ideal domains, modules. Polynomial algebra, Euclidean algorithm, unique factorization.
Prerequisite: Permission of the department.

- Mathematics 70.518W1 (MAT5147)
Homological Algebra and Category Theory
Axioms of set theory, categories, functors, natural transformations; free, projective, injective and flat modules; tensor products and homology functors, derived functors; dimension theory.
Prerequisite: Mathematics 70.310 or permission of the department.
I.S. Pressman and Luis Ribes.

● Mathematics 70.519W1 (MAT5142)

Algebra II

Field theory, algebraic and transcendental extensions, finite fields, Galois groups. Modules over principal ideal domains, decomposition of a linear transformation, Jordan normal form.

Prerequisites: Mathematics 70.517 (MAT5141) and permission of the department.

● Mathematics 70.521W1 (MAT5150)

Topics in Geometry

Various axiom systems of geometry. Detailed examinations of at least one modern approach to foundations, with emphasis upon the connections with group theory.

Prerequisite: Permission of the department.

C.W.L. Garner.

● Mathematics 70.522F1 (MAT5168)

Homology Theory

The Eilenberg-Steenrod axioms and their consequences, singular homology theory, applications to topology and algebra.

Prerequisite: Mathematics 70.425.

H.H. Schirmer and I.S. Pressman.

● Mathematics 70.525F1 (MAT5151)

Topology I

Topological spaces, product and identification topologies, countability and separation axioms, compactness, connectedness, metrization, net and filter convergence.

Prerequisite: Mathematics 70.301 or permission of the department.

● Mathematics 70.526 W1 (MAT5152)

Topology II

Homotopy, fundamental group, covering spaces, complexes, classification of two-dimensional manifolds.

Prerequisites: Mathematics 70.310 (MAT3143) and 70.525 (MAT5151) or permission of the department.

● Mathematics 70.527F1 (MAT5169)

Foundations of Geometry

A study of at least one modern axiom system of Euclidean and non-Euclidean geometry, embedding of hyperbolic and Euclidean geometries in the projective plane, groups of motions, models of non-Euclidean geometry.

Prerequisite: Mathematics 70.310 (may be taken concurrently) or permission of the department.

C.W.L. Garner and B.C. Mortimer.

● Mathematics 70.528F1 (MAT5155)

Differentiable Manifolds

A study of differentiable manifolds from the point of view of either differential topology or differential geometry. Topics such as smooth mappings, trans-

versality, intersection theory, vector fields on manifolds, Gaussian curvature, Riemannian manifolds, differential forms, tensors, and connections are included.

Prerequisite: Mathematics 70.301 or permission of the department.

H.H. Schirmer.

● Mathematics 70.535F1 (MAT5163)

Analytic Number Theory

Dirichlet series, characters, Zeta-functions, prime number theorem, Dirichlet's theorem on primes in arithmetic progressions, binary quadratic forms.

Prerequisite: Mathematics 70.307 or permission of the department.

K.S. Williams.

● Mathematics 70.536W1 (MAT5164)

Algebraic Number Theory

Algebraic number fields, bases, algebraic integers, integral bases, arithmetic in algebraic number fields, ideal theory, class number.

Prerequisite: Mathematics 70.310 or permission of the department.

K.S. Williams.

● Mathematics 70.540F1 (MAT5185)

Applied Mathematics I

Hamiltonian dynamics, integral invariants, non-holonomic systems, rigid body motions.

Prerequisite: Mathematics 70.345 or permission of the department.

Mizanur Rahman.

● Mathematics 70.541F1 (MAT5320)

Calculus of Variations

Extreme values of functionals; necessary conditions for an extremum. Sufficient conditions for an extremum. Hamilton-Jacobi Theory and the Maximum Principle of Pontryagin. The problem of Lagrange: the Isoperimetric problem.

Prerequisite: Mathematics 70.345 or permission of the department.

D.W. Sida.

● Mathematics 70.542W1 (MAT5186)

Applied Mathematics II

Hypergeometric and Generalized Hypergeometric functions; classical orthogonal polynomials in discrete and continuous variables. Confluent, Hypergeometric and Bessel functions. Asymptotic expansions; steepest descent, WKBJ approximation and other asymptotic methods.

Prerequisites: Mathematics 70.307 and 70.308, or permission of the department.

Mizanur Rahman.

● Mathematics 70.545F1 (MAT5131)

Ordinary Differential Equations

Existence and uniqueness theorems, boundary value problems, qualitative theory.

Prerequisite: Mathematics 70.308 or permission of the department.

● Mathematics 70.546F1 (MAT5133)

Introduction to Partial Differential Equations

First order linear, quasi-linear, and nonlinear equations; second order equations in two or more variables; systems of equations; the wave equation; Laplace and Poisson equations; Dirichlet and Neumann problems; Green's functions.

Prerequisites: Mathematics 70.302, or 70.307 and 70.308, or permission of the department.
J.N. Pandey.

● Mathematics 70.547W1 (MAT5134)

Topics in Partial Differential Equations

Theory of distributions, initial-value problems based on two-dimensional wave equations, Laplace transform, Fourier integral transform, diffusion problems, Helmholtz equation with application to boundary and initial-value problems in cylindrical and spherical co-ordinates.

Prerequisite: Mathematics 70.546 or permission of the department.
J.N. Pandey.

● Mathematics 70.550F1 (MAT5177)

Multivariate Normal Theory

Multivariate normal distribution properties, characterization, estimation of means, and covariance matrix. Regression approach to distribution theory of statistics; multivariate tests; correlations; classification of observations; Wilks' criteria.

Prerequisite: Mathematics 70.350.
D.K. Dale and Ehsanes Saleh.

● Mathematics 70.551W1 (MAT5191)

Statistical Inference

Sufficient statistics, simple and composite hypotheses, most powerful and similar region tests, distribution-free tests, confidence intervals, goodness-of-fit and likelihood ratio tests, large sample theory, Bayesian and likelihood methods, sequential tests.

Prerequisite: Mathematics 70.450 or permission of the department.
J.N.K. Rao and A.B.M.L. Kabir.

● Mathematics 70.552W1 (MAT5192)

Sampling Theory and Methods

Ratio and regression estimation theory; unequal probability sampling; multi-stage sample designs; two-phase sampling; interpenetrating samples;

domains of study; nonsampling errors; related topics.

Prerequisite: Mathematics 70.452 or permission of the department.
J.N.K. Rao.

● Mathematics 70.553F1 (MAT5193)

Analysis of Variance

The basic mathematical theory of the analysis of variance; mathematical models; estimable functions; Gauss-Markov theorems; confidence ellipsoids; tests of hypotheses; the one-way and some higher-way layouts; analysis of covariance.

Prerequisite: Mathematics 70.450 or permission of the department.
A.B.M.L. Kabir.

● Mathematics 70.554F1 (MAT5194)

Stochastic Processes and Time Series Analysis

Stationary stochastic processes, inference for stochastic processes, applications to time series and spatial series analysis.

Prerequisite: Mathematics 70.451 or permission of the department.
D.A. Dawson.

● Mathematics 70.555W1 (MAT5195)

Design of Experiments

Interpretation of factorial experiment; confounding; fractional replication; split plot, split block, Latin square, Graeco-Latin square, lattice and incomplete block designs; response surface techniques.

Prerequisite: Mathematics 70.355 and 70.450 or permission of the department.
J.N.K. Rao.

● Mathematics 70.556W1 (MAT5175)

Robust Statistical Inference

Nonparametric tests for location, scale, and regression parameters; derivation of rank tests; distribution theory of linear rank statistics and their efficiency. Robust estimation of location, scale and regression parameters; Huber's M-estimators, Rank-method, L-estimators. Influence function. Adaptive procedures.

Prerequisite: Mathematics 70.456 or permission of the department.
Miklos Csörgö and Ehsanes Saleh.

● Mathematics 70.557W1 (MAT5176)

Statistical Inference

Pure significance tests; uniformly (or locally) most powerful tests; likelihood ratio tests; tests of fit; asymptotic comparisons of tests; likelihood, Bayesian and empirical Bayesian methods; fiducial and structural arguments.

Prerequisite: Mathematics 70.450 or permission of the department.
J.N.K. Rao and Peter Tan.

● Mathematics 70.558F1 (MAT5172)

Topics in Stochastic Processes

Course contents will vary, but will include topics drawn from Markov processes. Brownian motion, stochastic differential equations, martingales, Markov random fields, random measures and infinite particle systems, advanced topics in modelling; population models, etc.

Prerequisites: Mathematics 70.356 and 70.451, or permission of the department.

Miklos Csörgö.

● Mathematics 70.559F1 (MAT5196)

Multivariate Analysis

Multivariate methods of data analysis, including principal components, cluster analysis, factor analysis, canonical correlation, MANOVA, profile analysis, discriminant analysis, path analysis.

Prerequisite: Mathematics 70.450 or permission of the department.

J.E. Graham.

● Mathematics 70.561F1 (MAT5197)

Stochastic Optimization

Topics chosen from stochastic dynamic programming, Markov decision processes, search theory, sequential inference problems, optimal stopping, analysis and solution of deterministic and stochastic modelling problems in the physical, social and life sciences. Students will present a paper on applications of particular interest to them.

Prerequisite: Mathematics 70.356 or permission of the department.

● Mathematics 70.562F1 (MAT5317)

Analysis of Categorical Data

Analysis of one-way and two-way tables of nominal data; multi-dimensional contingency tables and log-linear models; tests of symmetry and marginal homogeneity in square tables; incomplete tables; tables with ordered categories; fixed margins and logistic models with binary response; measures of association and agreement; applications in biological, social and medical sciences.

Prerequisites: Mathematics 70.450, 70.457/70.551 or permission of the department.

● Mathematics 70.563W1 (MAT5318)

Reliability and Survival Analysis

Types of censored data; nonparametric estimation of survival function; graphical procedures for model identification; parametric models and maximum likelihood estimation; exponential and Weibull regression models; nonparametric hazard function models and associated statistical inference; rank test with censored data; engineering, medical and biological sciences applications.

Prerequisites: Mathematics 70.450, 70.457/70.551 or permission of the department.

● Mathematics 70.565F1 (MAT5165)

Theory of Automata

Algebraic structure of sequential machines, decomposition of machines; finite automata, formal languages; complexity.

Prerequisite: Mathematics 70.210 or permission of the department.

Vlastimil Dlab and J.C. Poland.

● Mathematics 70.567F1 (MAT5324)

Game Theory

Two-person zero-sum games; infinite games; multi-stage games; differential games; utility theory; two-person general-sum games; bargaining problem; n-person games; games with a continuum of players.

Prerequisite: Mathematics 70.301 or permission of the department.

Peter Tan.

● Mathematics 70.569F1 (MAT5301)

Topics in Combinatorial Mathematics

Prerequisite: Permission of the department.

● Mathematics 70.571W1 (MAT5198)

Stochastic Models

Markov systems, stochastic networks, queueing networks, spatial processes, approximation methods in stochastic processes and queueing theory. Applications to the modelling and analysis of computer-communications systems and other distributed networks.

Prerequisite: Mathematics 70.356 or permission of the department.

D.A. Dawson.

● Mathematics 70.578F1 (MAT5170)

Probability Theory I

Probability spaces, random variables, expected values as integrals, joint distributions, independence and product measures, cumulative distribution functions and extensions of probability measures, Borel-Cantelli lemmas, convergence concepts, independent identically distributed sequences of random variables, laws of large numbers.

Prerequisites: Mathematics 70.301, 70.302 and 70.507 or permission of the department.

● Mathematics 70.579W1 (MAT5171)

Probability Theory II

Laws of large numbers, characteristic functions, central limit theorem, conditional probabilities and expectation, basic properties and convergence theorems for martingales, introduction to Brownian motion.

Prerequisite: Mathematics 70.578 (MAT5170) or permission of the department.

● Mathematics 70.581F1 (MAT5303)

Linear Optimization

Linear programming problems; simplex method, upper bounded variables, free variables; duality; post-optimality analysis; linear programs having special structures; integer programming problems; unimodularity; knapsack problem.

Prerequisite: A course in linear algebra and permission of the department.

Frantisek Fiala.

● Mathematics 70.582W1 (MAT5325)

Topics in Information and Systems Science

The purpose of this course is to bring together fundamental results in the new and active area of design and analysis of efficient computer algorithms for large, complex problems. Areas of application include data manipulation, computer networks, analysis, queueing systems, optimization, etc.

(Also offered as Engineering 94.582)

R.J.A. Buhr, Frantisek Fiala, and B.C. Mortimer.

● Mathematics 70.583W1 (MAT5304)

Nonlinear Optimization

Methods for unconstrained and constrained optimization problems; Kuhn-Tucker conditions; penalty functions, duality; quadratic programming; geometric programming; separable programming; integer nonlinear programming; pseudo-Boolean programming; dynamic programming.

Prerequisite: Permission of the department.

W.H. Cunningham.

● Mathematics 70.584F1, W1, S1 (MAT5307)

Topics in Operations Research

● Mathematics 70.585F1, W1, S1 (MAT5308)

Topics in Algorithm Design

● Mathematics 70.586F1 (MAT5180)

Numerical Analysis

Error analysis for fixed and floating point arithmetic; systems of linear equations; eigen-value problems; sparse matrices; interpolation and approximation, including Fourier approximation; numerical solution of ordinary and partial differential equations.

Prerequisite: Permission of the department.

L.E. May.

● Mathematics 70/95.587F1 (MAT5167)

Formal Language and Syntax Analysis

Computability, unsolvable and NP-hard problems.

Formal languages, classes of language automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient

parsers, LR, LR(O), LR(k), SLR, LL(k). Syntax directed translation.

Prerequisites: Mathematics 70.565 or 70.485 or Computer Science 95.302, or permission of the department.

● Mathematics 70.588W1 (MAT5305)

Combinatorial Optimization

Network flow theory and related material. Topics will include shortest paths, minimum spanning trees, maximum flows, minimum cost flows. Optimal matching in bipartite graphs.

Prerequisite: Permission of the department.

W.H. Cunningham and B.C. Mortimer.

● Mathematics 70.589W1 (MAT5306)

Combinatorial Optimization

Topics include optimal matching in non-bipartite graphs, Euler tours and the Chinese Postman problem. Other extensions of network flows: dynamic flows, multicommodity flows, and flows with gains. Bottleneck problems. Matroid optimization. Enumerative and heuristic algorithms for the Travelling Salesman and other "hard" problems.

Prerequisite: Mathematics 70.588.

W.H. Cunningham.

● Mathematics 70.590F1, W1, S1 (MAT5990)
Seminar

● Mathematics 70.591F1, W1, S1 (MAT5991)
Directed Studies

● Mathematics 70.593F1, W1, S1
Project

This course is intended for students registered in the M.Sc. degree program in Information and Systems Science and the M.C.S. program. Students pursuing the non-thesis option will conduct a study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a typewritten report and presented at a departmental seminar.

● Mathematics 70.594F1, W1, S1
Co-operative Project

This course is intended for students registered in the co-operative master's program in statistics. Students will register in this course during their work term; a grade will be assigned on the basis of a report submitted at the end of the work term.

● Mathematics 70/94/95.595F4, W4, S4
M.C.S. Thesis

● Mathematics 70/94.598F3, W3, S3
M.Sc. Thesis in Information and Systems Science

● Mathematics 70.599F2, W2, S2
M.Sc. Thesis

- Mathematics 70.601W1 (MAT5316)

Topological Vector Spaces

Construction of new topological vector spaces out of given ones; local convexity and the Hahn-Banach theorem; compactness and the Krein-Milman theorem; conjugate spaces, polar sets.

Prerequisite: Mathematics 70.403.

L.D. Nel.

- Mathematics 70.602W1 (MAT5309)

Harmonic Analysis on Groups

Transformation groups; Haar measure; unitary representations of locally compact groups; completeness and compact groups; character theory; decomposition.

B.M. Puttaswamaiah.

- Mathematics 70.608F1, W1, S1 (MAT5326)

Topics in Analysis

- Mathematics 70.611F1, W1, S1 (MAT5327)

Topics in Algebra

- Mathematics 70.614W1 (MAT5158)

Lie Groups

Matrix groups: one-parameter groups, exponential map, Campbell-Hausdorff formula, Lie algebra of a matrix group, integration on matrix groups.

Abstract Lie groups.

Prerequisite: Mathematics 70.507 and 50.517 or permission of the department.

- Mathematics 70.621F1, W1, S1 (MAT5312)

Topics in Topology

- Mathematics 70.657F1, W1, S1 (MAT5313)

Topics in Probability and Statistics

- Mathematics 70.658F1, W1, S1 (MAT5314)

Topics in Probability and Statistics

- Mathematics 70.690F1, W1, S1 (MAT6990)

Seminar

- Mathematics 70.691F1, W1, S1 (MAT6991)

Directed Studies

- Mathematics 70.699F, W, S

Ph.D. Thesis

Ottawa-Carleton Centre for Graduate Studies and Research in Physics

The Centre

Director of the Centre: R.J.W. Hodgson

Associate Director: P.J.S. Watson

Students wishing to pursue studies in physics at the M.Sc. and Ph.D. levels in the Ottawa area do so in a co-operative program that combines the resources of the Departments of Physics of Carleton University and the University of Ottawa. The two universities have a joint committee supervising the programs, regulations and student admissions.

Students are admitted for graduate work under the general regulations of the centre, which include criteria related to academic performance, research experience and referees' appraisals. The choice of program and/or research project and supervisor will determine the primary campus location of the student. The student's advisory committee will normally include faculty members from both universities.

The areas of physics available for programs leading to the M.Sc. or Ph.D. degree are indicated by the research interests of the members of the centre listed below. An M.Sc. by course work, with no thesis, is also possible.

Requests for information and completed applications should be sent to the director of the centre.

Members of the Centre

A.J. Alcock, *Laser and plasma physics*

J.C. Armitage, *High energy physics, instrumentation*

P.R. Bunker, *Molecular-Spectroscopy*

R.K. Carnegie, *Experimental high energy physics*

A.L. Carter, *Intermediate energy physics, instrumentation*

R.L. Clarke, *Medical physics*

T.J.S. Cole, *Geochronology*

L.A. Copley, *Theoretical particle physics*

K.W. Edwards, *Experimental high energy physics*

P.G. Estabrooks, *Experimental high energy physics*

Emery Fortin, *Semiconductor physics*

H.R. Glyde, *Condensed matter theory*

J.E. Hardy, *Field theory*

C.K. Hargrove, *Experimental high energy physics*

Jacques Hebert, *High energy physics*

R.J. Hemingway, *Experimental high energy physics*

Gerhard Herzberg, *Molecular spectroscopy*

Brian Hird, *Atomic collisions*

R.J.W. Hodgson, *Theoretical nuclear physics*

Dan Kessler, *Astrophysics*

Gilles Lamarche, *Low temperature physics*

M.A.R. LeBlanc, *Superconductivity*

B.A. Logan, *Nuclear physics*

Armen Manoojian, *Electron spin resonance*

Lazer Resnick, *Theoretical particle physics*

W.J. Romo, *Theoretical nuclear and particle physics*

A.K.S. Song, *Theoretical studies in solid state*

M.K. Sundaresan, *Theoretical particle physics*

Roger Taylor, *Condensed matter theory*

Y.P. Varshni, *Theoretical solid state, astrophysics*

P.J.S. Watson, *Theoretical particle physics*

J.C. Woolley, *Semiconductor physics*

Master of Science

Admission Requirements

An honours B.Sc. in Physics or a closely related field at a standard acceptable to the two universities is normally required for admission into the M.Sc. program. The admissions committee may require students to take an orientation examination during the first weeks of residence. The results of this examination may indicate the need for a student to register in undergraduate courses to fill gaps in his/her knowledge.

Program Requirements

Normally the requirements for the M.Sc. degree will consist of:

- A minimum of one and one-half (1 ½) full-course equivalents (9 term contact hours) of which a minimum of one full-course (6 term contact hours) must be at the graduate level. Candidates admitted with more than these minimum requirements may be permitted to credit towards the degree a maximum of one full-course credit at the senior undergraduate level. The above maximum does not apply to qualifying-year students
 - A thesis which will be defended at an oral examination
 - Participation in the seminar series of the centre.
- In special cases, the requirements may also be met by taking five full-courses and no thesis. In this case, one of the courses must be the selected topics course; a comprehensive examination and participation in the seminar series will also be required.

Doctor of Philosophy

Admission Requirements

An M.Sc. in physics or a closely related field, is normally required for admission into the Ph.D. program. Students who have been admitted to the M.Sc. program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research.

In exceptional cases, an outstanding student who has completed the honours B.Sc. will also be considered.

Program Requirements (from M.Sc.)

The normal requirements for the Ph.D. degree (after M.Sc.) are:

- A minimum of two full-course equivalents at the graduate level (12 term contact hours)
- A comprehensive examination with emphasis on areas chosen by the candidate's advisory committee in consultation with the candidate (an oral examination and/or a written examination normally at the end of the first full year of study)
- A thesis which will be defended at an oral examination. The examining board for all these will include members of the centre from both Departments of Physics. The external examiner of the thesis will be external to both Departments of Physics
- Participation in the seminar series of the centre.

Residence Requirements

For the M.Sc. degree

- at least one year of full-time study (or the equivalent)

For the Ph.D. degree (from B.Sc.)

- at least three years of full-time study (or the equivalent)

For the Ph.D. degree (from M.Sc.)

- at least two years of full-time study (or the equivalent).

Graduate Courses*

Some of the following are regarded as the core courses and are taught either at Carleton University or at the University of Ottawa. The more specialized courses are *only* taught at the indicated campus. Most of the core courses will be offered each year, but only a selection of the others. If enrollment is small, a course may be given as a reading course. In addition to the formal prerequisites for a course, any course requires permission of the department.

The following courses may be offered either at Carleton University or the University of Ottawa.

- **Physics 75.561F1 (PHY8161)**
Experimental Techniques of Nuclear and Elementary Particle Physics
The interaction of radiation and high energy particles with matter; experimental methods of detection and acceleration of particles; use of relativistic kinematics; counting statistics.
Prerequisites: Physics 75.437 and 75.477.
- **Physics 75.562W1 (PHY8162)**
Physics of Elementary Particles
Properties of leptons, quarks, and hadrons. The fundamental interactions. Conservation laws; invariance principles and quantum numbers. Resonances observed in hadron-hadron interactions. Three body phase space. Dalitz plot. Quark model of hadrons, mass formulae. Weak interactions; parity violation, decay of neutral kaons; CP violation; Cabibbo theory.
Prerequisite: Physics 75.477.
- **Physics 75.571F1 (PHY8171)**
Intermediate Quantum Mechanics with Applications
Angular momentum and rotation operations; Wigner and Racah coefficients; several and many electron problem in atoms; variational and Hartree-Fock formalism; introduction to second quantized field theory; scattering theory.
Prerequisites: Physics 75.477 and 75.478.
- **Physics 75.581F1 (PHY8181)**
Methods of Theoretical Physics I
This course and Physics 75.582 are designed for students who wish to acquire a wide background of mathematical techniques. Topics can include complex variables, evaluation of integrals, approximation techniques, dispersion relations, Padé approximants, boundary value problems, Green's functions, integral equations, and group theory.

The following courses are offered only at Carleton University.

- **Physics 75.511F1 (PHY8111)**
Classical Mechanics and Theory of Fields
Hamilton's principle; conservation laws; canonical transformations; Hamilton-Jacobi theory; Lagrangian formulation of classical field theory.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

● Physics 75.522W1 (PHY8122)

Molecular Spectroscopy

Spectra of simple molecules; brief survey of atomic spectroscopy; rotations and vibrations of diatomic and polyatomic molecules and the methods of obtaining information about the geometrical structure of the molecule, and the forces acting between the constituent particles from the observed rotation and vibration spectra; electronic structure of molecules as derived from a study of electronic spectra based mainly on molecular orbital theory. The description will be from the point of view of the experimentalist rather than the theorist.

(Also offered as Chemistry 65.509)

● Physics 75.532W1 (PHY8132)

Classical Electrodynamics

Covariant formulation of electrodynamics; Lenard-Wiechert potentials; radiation reaction; plasma physics; dispersion relations.

Prerequisite: Physics 75.437 or equivalent.

● Physics 75.553F1 (PHY8153)

Reactor Physics I

Brief review of orthogonal co-ordinate systems; divergence, Laplacian, etc., in various co-ordinate systems; continuity equation; flow equations (heat, current, neutrons); diffusion of thermal neutrons (collisional energy transfer, scattering probability, statistical energy degradation); Fermi age-velocity theory; fast neutron flow equation; thermal multiplication pile; criticality criteria; solutions of flow and continuity equations; heat flow (various geometries and boundary conditions), neutron flow (moderation by graphite block).

Prerequisites: Physics 75.381 and 75.386.

● Physics 75.564W1 (PHY8164)

Intermediate Nuclear Physics

Properties of the deuteron and the neutron-proton force. Nucleon-nucleon forces, isospin and charge independence. Nuclear models; single particle shell model, shell model with interactions, pairing, quasi-particles, collective models, deformed shell model. Scattering theory; effective range theory, partial wave analysis, phase shifts. Interpretation of n-p and p-p scattering experiments. Interaction of nucleons with electrons. Interaction of nuclei with radiation; multipole fields, transition rates, selection rules, internal conversion.

Prerequisite: Physics 75.468 or equivalent.

● Physics 75.572W1 (PHY8172)

Relativistic Quantum Mechanics

Relativistic wave equations. Expansion of S matrix in Feynman perturbation series. Feynman rules. An introduction to quantum electrodynamics without second quantization.

Prerequisite: Physics 75.571.

● Physics 75.582W1 (PHY8182)

Methods of Theoretical Physics II

This course complements 75.581. Topics include group theory, discussion of SU_2 , SU_3 , and other symmetry groups. Lorentz group. Integral equations and eigenvalue problems.

● Physics 75.590T2 (PHY8290)

Selected Topics in Physics (M.Sc.)

A student may, with the permission of the department, take more than one selected topic, in which case each full-course in Physics 75.590 will be counted for credit. Not more than one selected topic may be taken for credit in any one academic year.

● Physics 75.591F1, W1, S1 (PHY8191)

Selected Topics in Physics (M.Sc.)

● Physics 75.599F, W, S (PHY8199)

M.Sc. Thesis

● Physics 75.663W1 (PHY8163)

Topics in Elementary Particle Physics Phenomenology

This course is intended to develop familiarity with a wide variety of phenomenological concepts of current interest in dealing with elementary particle interactions.

Prerequisites: Physics 75.562, 75.571 and 75.572.

● Physics 75.671F1 (PHY8173)

Quantum Electrodynamics

Relativistic quantum field theory; second quantization of Bose and Fermi fields; reduction and LSZ formalism; perturbation expansion and proof of renormalizability of quantum electrodynamics; calculations of radiative corrections and applications.

Prerequisites: Physics 75.511, 75.532, 75.571 and 75.572.

● Physics 75.690T2 (PHY8490)

Selected Topics in Physics (Ph.D.)

● Physics 75.691F1, W1 (PHY8391)

Selected Topics in Physics (Ph.D.)

● Physics 75.699F, W, S

Ph.D. Thesis

The following courses, offered at the University of Ottawa, may be taken for credit by Carleton students.

● Physics 74.541 (PHY5100)

Solid State Physics I

General classification of solids. Theory of metals, free electrons, electrons in a periodic potential and band structure. Electron dynamics and Boltzmann equation in metals and semiconductors. Dynamics of ions, harmonic vibration and phonon dispersion. X-ray and neutron scattering, specific heat and thermal conductivity.

● Physics 74.542 (PHY5110)

Solid State Physics II

Elements of group theory. Band structure, tight binding and other approximations, Hartree-Fock theory. Measuring the Fermi surface. Boltzmann equation and semiconductors. Diamagnetism, paramagnetism and magnetic ordering. Superconductivity.

● Physics 74.543 (PHY5150)

Superconductivity I

Type I and II superconductors. Ginzburg-Landau theory, B.C.S. theory, flux quantization, Abrikosov vortex model.

Prerequisite: PHY4370 or equivalent.

● Physics 74.544 (PHY5180)

Symmetry Properties of the Solid State

Crystallographic symmetry elements. Point groups and representation. Space groups. Properties of crystalline materials. Effect of ordering. Application to semiconductors.

● Physics 74.545 (PHY5181)

Metallurgical Physics

Equilibrium diagrams and phase changes — phase rule and free energy. Superlattices and order-disorder effects. Methods of crystal growth. Interpretation of X-ray photographs, etc. Structure determinations.

● Physics 74.546 (PHY5184)

Transport Properties of Solids

Electrical and thermal conduction in metals. Selected topics.

Prerequisite: PHY4385 or equivalent.

● Physics 74.547 (PHY5380)

Semiconductor Physics I

Brillouin zones and band theory. E-k diagram, effective mass tensors, etc. Electrical properties of semiconductors. Conduction, hall effect, magneto-resistance. Scattering processes. Multivalley models and non-parabolic bands.

Prerequisite: PHY4380 or equivalent.

● Physics 74.548 (PHY5381, PHY5781)

Semiconductor Physics II — Optical Properties

Optical constants and dispersion theory. Optical absorption, reflection and band structure. Absorption at band edge and excitons. Lattice, defect and free carrier absorption. Magneto-optics. Photo-electronic properties, luminescence, detector theory. Experimental methods.

Prerequisite: PHY4380 or equivalent.

● Physics 74.549 (PHY5951)

Low Temperature Physics II

Helium 3 and Helium 4 cryostats. Dilution refrigerators. Theory and techniques of adiabatic de-

magnetization. Thermometry at low temperatures. Problems of thermal equilibrium and of thermal isolation. Properties of matter at very low temperature.

Prerequisite: PHY4355 or equivalent.

● Physics 74.561 (PHY5125)

Charged Particle Dynamics

Transport of charged particles through vacuum systems. Focusing properties of electric and magnetic field configurations. Examples from mass spectrometers, spectrographs.

● Physics 74.562 (PHY5162)

Applications of Nuclear Physics in Other Fields in Physics

A selection of topics from: Mossbauer effect, fundamental conservation laws, astrophysics, optical spectroscopy.

Prerequisite: PHY4360 or equivalent.

● Physics 74.563 (PHY5310)

Atomic Collisions in Solids

Energy loss of energetic particles in passing through solids. Stopping cross sections. The influence of the crystal lattice on nuclear stopping. Crystal lattice effects at high energies. Channelling and blocking. The collision cascade. Charge states of fast ions in solids from thin foil and X-ray measurements.

● Physics 74.564 (PHY5350)

Atomic Structure

A survey of the notation and conventions used to describe the states of isolated single atoms and diatomic molecules. The relative magnitudes of the term, the fine structure and the hyperfine structure energies. The energies of rotation and vibration states and the coupling between them and to the electronic motion in diatomic molecules. Hund's rules for small molecules. The effects of external fields. Electromagnetic decay selection rules and decay rates.

Prerequisite: PHY4370 or equivalent.

● Physics 74.565 (PHY5365)

Atomic Collisions in Gases

Atomic cross sections. Heavy particle collision theory. Born-Oppenheimer approximation. Adiabatic approximation. Molecular orbit model. Lichten-Fano model. Nonadiabatic processes. Survey of experimental status. Inner shell vacancy production. Nonviolent inelastic collisions. High energy collision theory. Negative ion detachment.

Prerequisite: PHY5350 or equivalent.

● Physics 74.566 (PHY5965)

Cosmic Rays and Nuclear Interaction at Very High Energies

Interaction of charged particles with matter. Abundance of elements in the cosmic radiation. Analysis of particle cascades produced in interactions of energy greater than 1000 GeV.

Prerequisite: PHY4360 or equivalent.

● Physics 74.572 (PHY6170)

Quantum Mechanics IV

Systems of identical particles. Scattering theory. Relativistic Quantum Mechanics. Applications in nuclear physics.

Prerequisite: PHY5170 or equivalent.

● Physics 74.641 (PHY6150)

Superconductivity II

Flux flow phenomena, superelectron tunneling, Josephson D.C. and A.C. effects, Bean-Kim-Anderson critical state model.

Prerequisite: PHY4370 or equivalent.

● Physics 74.642 (PHY6180)

Symmetry Properties of the Solid State II

Introduction to group theory. Group representations. Abelian groups, irreducible representation, etc. Application to crystallographic point groups. Reciprocal lattice and Brillouin zones. Wave vector group. Spin-orbit coupling.

Prerequisite: PHY5180 or equivalent.

● Physics 74.643 (PHY6340)

Statistical Mechanics

Boltzmann's equation. Electrical conduction in semiconductors. Relaxation time. Magneto-resistance. Scattering mechanisms; deformation potential, impurity, piezo-electric, optical polar, electron-hole. Thermal conduction in semiconductors.

Prerequisite: PHY5380.

● Physics 74.644 (PHY6920)

Advanced Magnetism II

Selected topics in nuclear and electronic magnetic resonances.

Prerequisite: PHY5920.

● Physics 74.645 (PHY7181)

Some Applications of Crystal Field Theory

Effect of crystalline electric field and magnetic interactions on magnetic centres in solids. Energy level splittings. Spin Hamiltonian formulation.

Paramagnetic resonance. Magnetic susceptibility.

Optical transitions, etc.

Prerequisite: PHY6180.

● Physics 74.661 (PHY6160)

Nuclear Structure

Static nuclear properties. Current nuclear models. Methods of calculating energies and properties of nuclear levels. Nuclear matter.

Prerequisites: PHY4360 and PHY5170.

● Physics 74.671 (PHY6171)

Quantum Mechanics V

Topics in advanced quantum mechanics selected from: second quantization diagram techniques. Green function techniques, formal theory of scattering.

Prerequisite: PHY5170 or equivalent.

The School

Director of the School: F. Fiala

Supervisor of Graduate Studies: M.D. Atkinson

The Master of Computer Science (M.C.S.) degree program is offered jointly by the School of Computer Science, the Department of Systems and Computer Engineering, and the Department of Mathematics and Statistics. It is a joint program with the Department of Computer Science at the University of Ottawa, and hence students are also able to take courses offered there.

Applicants to the M.C.S. program are required to have an honours degree in computer science (or the equivalent). The program is fully described on page 117 of this calendar.

Within the school, the principal research interests of the faculty include the following fields:

Programming systems and languages, expert systems, design and analysis of algorithms, information structures, arithmetic complexity, distributed and parallel computing, computing within algebraic structures, combinatorial optimization, artificial intelligence, computer graphics, statistical and syntactic pattern recognition, computerized adaptive learning, database systems, distributed systems, performance and modelling, office automation, business information systems, and computer architecture.

Students in the M.C.S. program have access to an extensive range of computing resources. Campus-wide facilities are provided by two Honeywell Level 66 Systems, one of which is dedicated to research, each having full supporting peripherals and software. Several micro-computer networks are also available. In addition, the School of Computer Science has established its own laboratories, which house many 8-bit and 16-bit micro-computers, a LISP machine, and a variety of graphics machines.

Graduate Courses*

● Computer Science 95.501F1

Foundations of Programming Languages

This course will study current topics in the theory and practice of programming language design and implementation. Different styles of languages: imperative, applicative, logic, constraints, object-centred, dataflow, production systems. Abstraction mechanisms; primitives; extensibility; procedural v. declarative semantics; interpretation; compilation; program transformations.

Prerequisite: Computer Science 95.207 or the equivalent.

● Computer Science 95.502W1

End-User Facilities

End-user facilities are software/hardware systems which allow a non-programmer to access and manipulate objects stored in a computer system. This course is concerned with the design criteria and algorithms used to construct a variety of end-user facilities. Processors discussed in the course include text editors and formatters; query languages; application program generators and non-procedural programming. Alternative user-oriented programming paradigms are compared and contrasted, such as programming by example, by dialogue, object-oriented programming, menu driven. Some current end-user applications are examined to show programming paradigm; human/machine interface; implementation algorithms and data structures. Typical example systems include VISICALC, QBE, SEQUEL, SBA, SMALLTALK, MODEL II, SCRIPT/SCRIBE/TEX/EMACS/ SP/.

Prerequisite: Permission of the school.

● Computer Science 95.503F1

Principles of Distributed Computing

Formal models; semantics of distributed computations; theoretical issues in design of distributed algorithms; computational complexity; reducibility and equivalence of distributed problems. Related topics: systolic systems and computations, oligarchical systems and control mechanisms.

Prerequisite: Permission of the school.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

● Computer Science 95.504W1

Topics in Arithmetic Complexity

Models of computation; preconditioning and polynomial evaluation; bilinear forms and tensor rank; matrix multiplication; lower bounds for selected problems; parallel algorithms and parallel complexity.

Prerequisite: Computer Science 95.484 or equivalent.

● Computer Science 95.505F1

Automata Models of Learning Systems

This course will introduce the students to computerized adaptive learning. Learning models in mathematical psychology will be discussed. Mathematical tools such as Markov chains and the solution of difference equations will be reviewed. The heart of the course will involve deterministic and stochastic learning automata, variable structure stochastic automata, operation in random environments, norms of learning, linear and nonlinear learning schemes, convergence problems, and discretized automata with ergodic and non-ergodic properties. Applications of learning automata in file allocation, game playing, path finding, optimization and decision making will be discussed.

Prerequisite: Mathematics 70.260 or 70.350, or Engineering 94.553, or equivalent.

● Computer Science 95.506W1

Natural Language Processing

This course will introduce the students to current research in Natural Language Processing. Some existing NLP programs will be surveyed and a number of applications will be described in detail. These applications include: human-machine interaction; knowledge acquisition; text analysis and CAI. Several major parsing strategies and approaches to semantics and pragmatics will be discussed. The topics covered will include: meaning representation based on frames; predicate logic; semantic networks and procedural languages; representation of pragmatic information; speech act theory; determination of focus and reference and flexible parsing. Students will be required to implement a prototype NLP in LISP.

Prerequisites: Computer Science 95.407 or equivalent.

● Computer Science 94/95.507F1

Expert Systems

Expert systems is a special field of artificial intelligence dealing with the design and construction of programs that provide information at the level of an "expert" in a specific area of interest. The existing expert systems and the current research in this area will be surveyed. Typical expert systems

deal with medical diagnosis, computer system configuring, and programmer's assistants. Moreover, the systems are generally implemented using one of two paradigms: the rule-based approach or the actor-based approach. Both approaches will be considered in depth. Prototype software implementations are expected. Students will be expected to have a strong programming background, and to be able to familiarize themselves with LISP within the first week should they not already know it.

Prerequisite: Permission of the school.

● Computer Science 95.508W1

Computational Geometry

This course will study the design and analysis of algorithms for solving geometrical problems. These algorithms have applications in such areas as computer graphics, pattern recognition and robotics. Topics will include: visibility problems, hidden line removal, classes of polygons, testing polygons for structural properties, convex hull problems, movability of objects through a set of obstacles, point inclusion in polygons, decomposition of objects into 'meaningful' components, triangulation and guard problems.

Prerequisite: Computer Science 95.384 or equivalent.

● Computer Science 95.509F1

Design of Information Retrieval Systems

This course will cover the fundamental concepts and advanced topics in the design of information retrieval systems as they relate to Database Systems, Information and Library Science. Topics will include Data Structures for Physical Database Design, Design and Analysis of Algorithms for Mass Storage Systems, Techniques for Evaluating Retrieval Efficiency. Text Analysis, Cataloguing and Classification, Query Formulation, Implementation and Optimization of Relation Algebraic Expressions. Hardware Approaches to Information Retrieval, Database Machines, Parallel and Associative Processors. Query Processing in a Distributed System.

Prerequisite: Computer Science 95.305 and 95.384 or equivalent.

● Computer Science 95/70.587F1

Formal Language and Syntax Analysis

Computability, unsolvable and NP-hard problems. Formal languages, classes of languages, automata. Principles of compiler design, syntax analysis, parsing (top-down, bottom-up), ambiguity, operator precedence, automatic construction of efficient parsers, LR, LR(O), LR(k), SLR, LL(k); syntax directed translation.

Prerequisite: Computer Science 95.302 or Mathematics 70.485 or 70.565 or equivalent.

- Computer Science 95.590F1, W1, S1

Selected Topics in Computer Science

Selected topics, not covered by other graduate courses, will be offered. Details will be available at the time of registration.

- Computer Science 95.591F1, W1, S1

Directed Studies

A course of independent study under the supervision of a member of the School of Computer Science, and open only to students in the M.C.S. program.

- Computer Science 95.592F1, W1, S1

Project

- Computer Science 70/94/95.595F, W, S

M.C.S. Thesis

Departmental

Program

Descriptions

and

Details

of

Courses

Faculty of Social
Sciences

Dean: D.P. Forcese

The School

Director of the School: A.J. Bailetti

The School of Business does not at present offer a graduate degree, but its courses are available to graduate students registered with other departments and schools. Business faculty also supervise graduate research.

Currently, the school offers six courses at the graduate level. The student's background, as well as the particular degree which is being sought, will influence the selection of courses. Business courses can be of particular interest to graduate students in Canadian studies, economics, engineering, international affairs, and public administration.

Students wishing to register in business courses should seek guidance and approval both from the School of Business and the department in which they are registered for their degree.

Graduate Courses*

- Business 42.510F1

Seminar in Management and Administration
A critical examination of current empirical research in the management of large organizations. The purpose of the course is to provide the student with an understanding of current management theories and the critical skills to evaluate them.
David Cray.

- Business 42.518W1

Marketing for Non-Profit Organizations
Examination of the concepts of marketing relative to public demand, and the market for social goods and services. Contemporary marketing approaches and practices are analyzed and applied to purposes, programs, and environments of government agencies and departments, educational institutions, charities, and other public and social services.
(Also offered as Administration 50.518)

- Business 42.520F1

Seminar in Marketing
This course examines issues in productivity and innovation as they relate to marketing. It focuses on the analytical tools that are necessary in order to identify and capitalize upon market opportunities, on the one hand, while making the most efficient and effective use of corporate resources on the other. More specifically, the course assumes the viewpoint of product portfolio management, and addresses problems such as market assessment, marketing audits and policy, new products, existing product management, and product line profitability.
G.H. Haines.

- Business 42.540F1

Seminar in Business Information Systems
This course examines the fundamentals of business information systems from the following viewpoints: information processing technology, design and development, impact on the business support systems. Particular emphasis is placed on identifying those opportunities where the use of information processing can significantly improve the productivity of the enterprise. Representative systems discussed in the course include: requirements analysis, transaction processing, data administration, decision support, office automation, point of sale, and factory automation.
Ehud Menipaz.

- Business 42.551W1

The Theory of Finance
An examination of the continuing evolution of the theory of valuation of capital assets under uncertainty, pricing of contingent claims, and the principles of arbitrage theory; the relationships between these contemporary approaches to valuation and the more traditional methods of the valuation of corporate claims. Examination of financial decisions from the perspective of information theory. (This course may not be taken by students who have completed 42.512.)
A.L. Riding.

- Business 42.590T1

Tutorials/Directed Studies in Business
Tutorials or directed readings in selected areas of business, involving presentation of papers as the basis for discussion with the tutor. A requirement for the course may be participation in an advanced business course at the undergraduate level.
J.R. Callahan.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of Economics

The Department

Chairman of the Department: D.A. Smith
Supervisor of M.A. Studies: J.I. Bernstein
Supervisor of Ph.D. Studies: D.G. McFetridge
Director of Joint Doctoral Program with the University of Ottawa: D.G. McFetridge

The Department of Economics offers programs of study and research leading to the M.A. and Ph.D. degrees.

Graduate students in economics undertake a thorough review of economic theory, together with an analysis of the Canadian economy, its institutions and history, and the working of public policy. Stress is placed on the understanding and application of quantitative methods to all aspects of economics. Although the programs are generally oriented towards policy problems, there is considerable opportunity for the development of specialized interests.

The main areas of specialization within the department include the following:

- Industrial Organization
- Public Finance
- Money and Trade
- Urban and Regional Economics
- Economic Theory
- Quantitative Methods

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a qualifying-year program designed to raise their standing to honours status. If successful, they may be permitted to proceed to the master's program the following year.

Refer to the general section of this calendar for details of the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is an Ontario honours B.A. (or the equivalent) in Economics, with at least high second-class standing.

Applicants are expected to have had adequate preparation in statistics and mathematics. Credit in the following two undergraduate courses (or their equivalents) will be accepted: Economics 43.220: Statistical Methods in the Social Sciences, or Mathematics 69.109: Calculus: with Applications to Business and Economics, and Mathematics 69.119: Algebra: with Applications to Business and Economics. Students who do not satisfy the statistics requirement will be asked to take Economics 43.592: Econometric Methods, prior to proceeding to Economics 43.505: Econometrics. Students with inadequate mathematical backgrounds will be required to enrol in Economics 43.593: Mathematical Methods for Economists.

The department may require certain applicants to write the Graduate Record Examination aptitude test and the Advanced Test in Economics offered by the Educational Testing Service.

Program Requirements

All master's students in economics are required to complete the following courses:

Economics

- 43.501 Microeconomic Theory I
- 43.502 Macroeconomic Theory I
- 43.503 Microeconomic Theory II
- 43.504 Macroeconomic Theory II
- 43.505 Econometrics

The Microeconomic Theory II and Macroeconomic Theory II courses serve to prepare candidates for the written M.A. comprehensive examination. Details of this examination are outlined below.

In addition, each candidate must select and complete one of the following:

- A thesis, equivalent to 1½ credits and approved course(s) for one credit
- Approved courses for 2½ credits, one of which may be selected from among those offered in a related discipline, with permission of the department, through the supervisor of M.A. studies.

Comprehensive Examinations

Master's candidates in economics must undertake a written comprehensive examination to demonstrate their knowledge of economic theory and its policy implications. This examination is prepared by the instructors of the Microeconomic Theory II and Macroeconomic Theory II courses in consultation with the supervisor of M.A. studies.

Academic Standing

A grade of B- or better must normally be obtained in each course counted towards the master's degree. A candidate may, with the recommendation of the department, be allowed a grade of C+ or C (but not C-) in one full course or each of two half-courses.

Doctor of Philosophy

The Carleton Ph.D. program is principally concerned with Canadian economic policy.

The course content of the program must be undertaken on a full-time basis; completion of the overall Ph.D. requirements entails a minimum of two years of study.

In July 1981, a new Ph.D. program in Canadian economic policy and economic development was launched, offered jointly by the combined economics departments of Carleton University and the University of Ottawa. Details of that new program follow on page 164 of this calendar.

Students registered in the Ph.D. program at Carleton prior to the fall of 1981 will continue to follow the requirements and courses as outlined up to page 164 of this calendar.

Admission Requirements

The normal requirement for admission into the Ph.D. program is a master's degree (or the equivalent) from a recognized university, with high second-class standing. The department may require certain applicants to write a comprehensive entrance examination.

Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance, and who demonstrates high promise for advanced research during the master's program may, subject to meeting the requirements below, be permitted to transfer into the Ph.D. program without completing the M.A. program.

- The student will have completed Economics 43.501, 43.502, 43.505, plus an additional four half-courses at the graduate level
- The student must make formal application to the Graduate Studies Committee at least one month before the beginning of the term in which he/she wishes to begin the Ph.D. program
- Students permitted to transfer into the Ph.D. program will be required to complete the equivalent of 11½ courses.

Program Requirements

Ph.D. candidates are expected to have or acquire proficiency in mathematics and statistics; this requirement must be satisfied before proceeding with the program.

Doctoral candidates would usually complete:

Economics

- 43.600 Economic Theory: Microeconomics
- 43.601 Economic Theory: Macroeconomics
- 43.602 Analysis of Microeconomic Policy
- 43.603 Analysis of Macroeconomic Policy
- 43.606 Economic Models and Policy Applications
- 43.611 Workshop in Economic Policy
- Four other graduate half-courses (or the equivalent) in economics; with the permission of the department, through the supervisor of Ph.D. studies, one full course may be selected from a related discipline
- A formal dissertation, equivalent to five full-course credits, which must be defended at an oral examination
- Three written comprehensive examinations (theory, policy, and an optional field).

Academic Standing

Doctoral students must normally obtain a grade of B- or better in each course counted towards the degree.

Qualifying-Year Courses*

- Economics 43.590F1
Microeconomic Theory
This course is required for qualifying-year students whose preparation in microeconomic theory is judged to be inadequate.
- Economics 43.591W1
Macroeconomic Theory
This course is required for qualifying-year students whose preparation in macroeconomic theory is judged to be inadequate.
- Economics 43.592F1
Econometric Methods
Principles of statistical theory, probability, testing, and introduction to regression analysis.
Designed for those judged deficient in undergraduate statistical training.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Economics 43.593F1

Mathematical Methods for Economists

This course provides an introduction to the use of mathematical techniques in economics. Topics in optimization, such as Lagrangean multipliers and second order conditions, will be emphasized. Applications of these tools to various parts of economic theory will be presented.

- Economics 43.594F1, W1, S1

Qualifying-Year Tutorial

A tutorial for qualifying-year students whose program includes the full slate of qualifying-year core courses (microeconomic theory, macroeconomic theory, empirical methods, and applied economics).

- Economics 43.595F1, W1, S1

Qualifying-Year Directed Studies

- Economics 43.597F1, W1, S1

Qualifying-Year Directed Readings

Graduate Courses*

Enrolment in graduate courses requires the permission of the department, through the supervisor of graduate studies.

- Economics 43.501F1

Microeconomic Theory I

An examination of the theories of the behaviour of individual economic agents: consumers and producers and their relation to the theories of price determination.

- Economics 43.502F1

Macroeconomic Theory I

Macroeconomic theory and its implications for economic policy are surveyed in this course, comparing alternative approaches for a variety of topics.

- Economics 43.503W1, S1

Microeconomic Theory II

A continuation of Microeconomic Theory I.

- Economics 43.504W1, S1

Macroeconomic Theory II

A continuation of Macroeconomic Theory I.

- Economics 43.505F1

Econometrics

Estimation and testing of the general linear model,

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

with emphasis on problems such as autocorrelation, heteroscedasticity, multicollinearity, and problems due to distributed lags and errors in variables.

Introduction to simultaneous equations systems, identification, and estimation.

- Economics 43.507F1, W1, S1

Directed Readings

Prerequisite: Permission of the department.

- Economics 43.508F1, W1, S1

Special Topics

Prerequisite: Permission of the department.

- Economics 43.509F1, W1, S1

Directed Research

At least one paper will be required from a student enrolled in any one of these courses.

Prerequisite: Permission of the department.

- Economics 43.511F1

Canadian Economy I

A detailed examination of aspects and problems of the Canadian economy. A variety of topics may be discussed, including the economic development of Canada, the structure of the current national and regional economies, industrial organization, factor market operation, income distribution, the role of international trade and capital flows, and the stability of the economy.

- Economics 43.512W1

Canadian Economy II

Economic theory applied to the workings of the Canadian economy. Empirical estimation of various aspects of factor market operation, production, distribution, and aggregate economy. Participants are expected to prepare and present papers for discussion.

- Economics 43.521F1

History of Economic Thought I

The crucial achievements in economic theory and doctrine in the nineteenth and twentieth centuries are studied. Special emphasis is given to the inter-relationship between the social environment and economic thought — especially to the role of economics in the development of the national state and international institutions.

- Economics 43.522W1

History of Economic Thought II

A continuation of 43.521.

Prerequisite: Economics 43.521 or permission of the department.

- Economics 43.525F1 (ECO7125/7525)

Mathematical Economics

General equilibrium; dynamic optimization; game-theory.

● Economics 43.531F1 (ECO6140; 6540)

Firms and Markets

An examination of theories pertaining to industrial organization, and their application to particular industries in Canada and elsewhere by way of empirical studies.

● Economics 43.532W1 (ECO6141; 6541)

Competition Policy

An examination of the rationale and application of competition policy with particular attention to the Canadian economy.

● Economics 43.533S1 (ECO6142; 6542)

Regulation and Public Enterprise

An examination of regulation and public enterprise as alternative approaches for influencing industry conduct and performance.

● Economics 43.535F1 (ECO6143; 6543)

Economics of Natural Resources

Elements of dynamic optimization. Microeconomic theory of exhaustible natural resources, both renewable and non-renewable: exploration, development and production. Uncertainty: sources, types, the value of information, informational externalities, search. Optimal jurisdiction over regulation and taxation of natural resources. Canadian case studies. Macroeconomic theory: intergenerational equity, technological substitution and impact upon growth.

● Economics 43.538W1

Law and Economics

This is a course in the interrelationship of law and economics, emphasizing the concepts of transaction costs and property rights. Economic theory will be used to analyze a variety of topics, ranging from the allocative effects of alternative property rights structures to contract, tort, and nuisance law. Special attention will be given to applied problems, such as the economics of crime, pollution, pay television, and eminent domain.

● Economics 43.541F1 (ECO6130; 6530)

Public Economics: Expenditure

A discussion of the role of government expenditure, both in theory and with reference to the Canadian economy.

● Economics 43.542W1 (ECO6131; 6531)

Public Economics: Taxation

An analysis of the effects of various forms of taxation on economic performance.

● Economics 43.543W1 (ECO6133; 6533)

Public Choice

Democracy, bureaucracy, and economic policy. The public choice of fiscal constitutions, tax shares, and equity rules; voting coalitions and income distribution; the public provision of private goods; public sector size, fiscal illusion, and taxpayer revolts.

● Economics 43.544W1 (ECO6132; 6532)

Fiscal Federalism

This course examines the economic aspects of federalism, including efficiency, redistribution, consideration of a federal system of government, intergovernmental grants, and problems of stabilization policy in a federal context.

● Economics 43.545W1

Theoretical Welfare Economics

A rigorous treatment of the theoretical foundations of welfare economics. An introduction to axiomatic social choice theory, with emphasis on the determination of collective choice rules from individual choice rules, the various types of measurability and comparability assumptions and impossibility results of the Arrow-type.

● Economics 43.547W1

Project Evaluation

An analytical treatment of the principles of project evaluation and their applications.

Prerequisite: Economics 43.501 or permission of the department.

● Economics 43.550F1 (ECO6170; 6570)

Theory of Economic Development

This course will deal with theoretical approaches in the economic development literature in relation to the historical, economic, social and political dimensions of the development process.

● Economics 43.551F1

Economic Dynamics: Cycles

An analysis of the nature and causes of fluctuations in income, prices, and employment. Shortrun dynamic models arising from multiplier-accelerator and other economic processes will be examined. Cycle simulation, forecasting, stability conditions, anti-cyclical policy, and the problems of maximizing growth without cycles will be discussed.

● Economics 43.552W1

Economic Dynamics: Growth

An examination of modern theories of economic growth: constraints of renewable and non-renewable resources; trade-offs between economic growth and environmental decay; problems of inter- and intra-generational income distribution.

● Economics 43.553W1

Stabilization Policy

An examination of policies aimed at achieving internal and external stability. The implications of economic growth for stabilization policies will be discussed.

Prerequisite: Economics 43.502.

● Economics 43.554W1 (ECO6171; 6571)

Economic Development: Internal Aspects

An analysis of some major domestic problems of economic development. Topics may include employment, income distribution, choice of technology, sectoral allocation of resources and human resource development.

● Economics 43.555F1 (ECO6172; 6572)

Economic Development: International Aspects

An analysis of some key problems of international economic development such as trade in primary commodities and manufactures, foreign assistance, the role of multinational corporations and the transfer of technology.

● Economics 43.556W1 (ECO6309; 6709)

Planning for Economic Development

An analytical treatment of the principles of economic development planning and project evaluation and their applications.

● Economics 43.561F1 (ECO6160; 6560)

International Trade: Theory and Policy

International trade theory and its implications for economic policy are examined, with emphasis on topics such as determinants of trade and specialization, gains from trade and commercial policy, international factor mobility, growth, and development.

● Economics 43.562W1 (ECO6161; 6561)

International Monetary Theory and Policy

International monetary theory and its implications for economic policy are examined, with emphasis on topics such as sources of equilibrium and disequilibrium in the balance of payments, balance-of-payments adjustment under fixed versus flexible exchange rates, international capital movements, and recent issues in the international monetary system.

● Economics 43.563W1 (ECO6162; 6562)

Topics in International Economics

An examination of key topics in international economics, including theoretical analysis, quantitative methods and policy formulation, implementation, and evaluation.

● Economics 43.567F1

Monetary Theory and Policy I

This course is designed to provide the analytical tools of monetary theory and policy: the effects of monetary change on economic activity, the foundations of monetary theory, and classical, Keynesian, and modern monetary analyses are discussed. Also examined are the policy implications of the "optimum quantity of money", various estimates of money supply and demand, and difficulties of implementing policy in open and closed economies and in a growth context.

● Economics 43.568W1

Monetary Theory and Policy II

A continuation of 43.567.

Prerequisite: Economics 43.567 or permission of the department.

● Economics 43.571W1 (ECO7126; 7526)

Advanced Econometrics

Selected topics from estimating and testing the regression and simultaneous equation models are analyzed. The main topics include maximum likelihood estimation, statistical analysis of residuals, autoregressive and other time-series models, multivariate regression model, and elements of asymptotic statistical theory within the context of the simultaneous equation model.

Prerequisite: Economics 43.505 or equivalent.

● Economics 43.572W1

Applied Econometrics

A discussion of the major problems encountered in applying the tools and techniques of econometric methods to statistical data for economic analysis and forecasting. Some selected topics and papers from the applied econometric literature are critically analyzed and appraised.

Prerequisite: Economics 43.505 or equivalent.

● Economics 43.573W1

Applied Time Series Analysis

Introduces the basic concepts of time series analysis with emphasis on models used in economics. Topics include stationary and nonstationary time series, model identification and estimation, transfer functions, and forecast computation.

● Economics 43.581F1 (ECO6150; 6550)

Regional Economics

Regional economic disparities in Canada, theories and public policy relating thereto. Consideration will be given to the concept of regions, location of industry and industrial structure and to growth determinants.

● Economics 43.582W1 (ECO6151; 6551)

Urban Economics

An examination of the economic properties of urban areas. Attention will be focused on the macro-dynamics of urban development, together with the micro-statics of the equilibrium properties of the urban land market.

● Economics 43.583F1 (ECO6152; 6552)

Regional Policy

Analysis of policies directed toward less-prosperous regions.

● Economics 43.584W1 (ECO6153; 6553)

Urban Policy

An assessment of public policy in Canada on urban areas.

● Economics 43.586F1

Comparative Economic Systems I

This course builds a framework for the study and comparison of economic systems. Using basic economic tools, it discusses the properties and comparative advantages of different contemporary economies, as well as the forces that cause or prevent change. Some Marxian theory will be included, along with analyses of the role of property rights, of incentives and motivation, and of the interaction between economic and political systems.

● Economics 43.587W1

Comparative Economic Systems II

A comparison of contemporary economic systems. Such diverse economies as Japan, West Germany, Sweden, the USSR, China, Cuba, Yugoslavia, and Hungary may be explored.

Prerequisite: Economics 43.586 or permission of the department.

● Economics 43.599F3, W3, S3

M.A. Thesis

● Economics 43.600F1 (ECO7922)

Economic Theory: Microeconomics

An examination of critical aspects of micro-economic theory drawn from recent analysis of consumer behaviour, costs and production, transaction costs, uncertainty, and the organization of economic activity.

Prerequisite: Economics 43.501 or equivalent.

● Economics 43.601W1 (ECO7923)

Economic Theory: Macroeconomics

An examination of critical aspects of macro-economic theory drawn from recent analysis of the microeconomic foundations of macroeconomics, concepts of macroeconomic equilibrium and the impact of monetary and fiscal disturbances. Atten-

tion is also directed to a variety of topics related to the conduct of macroeconomic policy.

Prerequisite: Economics 43.502 or equivalent.

● Economics 43.602W1

Analysis of Microeconomic Policy

An examination and evaluation of microeconomic policies. Various aspects of policy issues are analyzed. These will be drawn from such areas as industrial economic policy, renewable and non-renewable resources, communication and transportation, regional economic policy, social economic policy, and operations of the labour market.

● Economics 43.603W1

Analysis of Macroeconomic Policy

An examination and evaluation of macroeconomic policies. Policy issues are discussed, alternative solutions formulated, and their outcomes considered. Attention will focus upon such areas as incomes policy, taxation and budgetary policy, central bank operations, exchange rate manipulation, and commercial policy.

● Economics 43.604W1 (ECO6123;6523)

Theory of Choice

The concept of choice in economics. Opportunity for choice. Criteria of choice. Individual choice. Collective and social choice. Methods of choice. Applications.

● Economics 43.606F1 (ECO7930)

Economic Models and Policy Applications

Selected topics in the literature of econometric model building and consideration of their relevance to the design of economic policy. Included is a survey and comparative analysis of existing Canadian and American macroeconomic models. A detailed examination of one Canadian model will be made, and students will have the opportunity to conduct policy simulations with it or another econometric model.

Prerequisite: Economics 43.505 or equivalent.

● Economics 43.607W1 (ECO7900)

Research Methods in Economics

Philosophy of science and scientific methods. A critique and an appraisal of the basic postulates of the classical, neo-classical, Marxian, Keynesian and post-Keynesian modes of theorizing in relation to the following three principles of scientific inquiry: rigor, realism and relevance. The concepts of structure, function, structural change and evolution. Structural stability and the theory of catastrophes in economics.

Prerequisites: Economics 43.505 or equivalent.

- Economics 43.608F1
Topics in Advanced Micro-Theory
- Economics 43.609W1
Topics in Advanced Macro-Theory
- Economics 43.611F1, W1, S1 (ECO7010; 7011; 7012)
Workshop in Economic Policy
Forums in which graduate students and faculty can work together on policy questions. Workshops will be held on urban and regional economics, economic organization and development, money and trade, public economics, and quantitative methods.

Doctoral students are required to join two workshops and present a paper to one of these groups.

Joint Doctoral Program students are governed by the regulations of that program.

- Economics 43.670F1, W1, S1 (ECO7980)
Reading Course in Canadian Economic Policy and Economic Development
- Economics 43.690W1, S1 (ECO7990)
Ph.D. Tutorial
Students must register in the microeconomics and macroeconomics tutorials in either the winter or spring term.
- Economics 43.699F10, W10, S10 (ECO9999)
Ph.D. Thesis

The courses listed below (up to and including 43.697) indicate the areas in which members of the department are prepared to supervise directed reading, research, and seminars. Not all the courses will necessarily be offered in any one year. Permission of the department is required.

- Economics 43.630F1
Industrial Organization I
- Economics 43.631W1
Industrial Organization II
- Economics 43.640F1
Public Finance I: Advanced Taxation Theory
- Economics 43.641W1
Public Finance II: Advanced Expenditure Theory
- Economics 43.660F1
Theory of International Trade
- Economics 43.661W1
Monetary Theory
- Economics 43.662W1
Balance of Payments and International Monetary Theory
- Economics 43.680F1
Urban and Regional Economics I

- Economics 43.681W1
Urban and Regional Economics II
- Economics 43.696F1, W1, S1
Selected Advanced Topics
- Economics 43.697T2
Selected Advanced Topics

Joint Doctoral Program

The doctoral program in Canadian economic policy and economic development, offered jointly by the Departments of Economics at Carleton University and the University of Ottawa, was launched in July, 1981.

This new Ph.D. program stresses the application of economic theory to the analysis of Canadian economic policy and economic development. Five areas of specialization are available for intensive study and thesis research: public economics, industrial organization, regional and urban economics, international economics, and economic development. The program of courses and thesis guidance, drawing upon the faculty of the two departments, will encompass course requirements, policy-oriented workshops, comprehensive examinations, and a thesis. Students who have achieved at least high second-class standing at the M.A. level in economics, or who have equivalent training, may be required to take one half-course at the graduate level in Canadian or North American economic history (or the equivalent) if they have not already taken such a course at the graduate level. Students are also expected to have, or to acquire proficiency in, mathematics and statistics before proceeding with the program.

Students admitted to the joint Ph.D. program are required to complete three compulsory half-courses: microeconomic theory, macroeconomic theory, and one of:

- advanced econometrics
- mathematical economics
- economic models and policy applications
- research methods in economics
- theory of choice.

Students are required to take three half-courses in each of two fields of specialization. Credit may be given for previous graduate courses in either of the chosen fields. Courses in the fields of specialization will be:

Public Economics

- Public Economics: Expenditure
- Public Economics: Taxation

- Public Choice
- Fiscal Federalism

Industrial Organization

- Firms and Markets
- Competition Policy
- Regulation and Public Enterprise
- Economics of Natural Resources

Regional and Urban Economics

- Regional Economics
- Urban Economics
- Regional Policy
- Urban Policy

International Economics

- International Trade: Theory and Policy
- International Monetary Theory and Policy
- Topics in International Economics
- Economic Development: International Aspects

Economic Development

- Theory of Economic Development
- Economic Development: Internal Aspects
- Economic Development: International Aspects
- Planning for Economic Development

Students must also attend workshops being offered by the two departments, those chosen being central to dissertation interest and research. They will receive credit for two half-courses for those two terms in which they make their presentations to the workshops. The workshops are:

- Government and the Market Place
- Evaluation and the Public Economy
- Canada and the World Economy

Each student will attend a full-course (or two half-courses) Ph.D. tutorial, will be required to write and defend orally three comprehensive examinations (theory and two fields), and will be required to write and defend orally a Ph.D. dissertation. Doctoral students will be required to obtain a grade of B- or better in each of the courses (required, field of specialization, workshop, tutorial) credited towards the degree.

Further details about this joint Ph.D. program may be obtained by writing to the director of doctoral studies, Joint Doctoral Program in Economics, either at the Department of Economics, Carleton University, or at the Department of Economics/Département de Science Économique, University of Ottawa.

Department of Geography

The Department

Chairman of the Department: T.P. Wilkinson
Departmental Supervisor of Graduate Studies:
J.P. Johnson

The Department of Geography offers programs of study and research leading to the degree of Master of Arts. Inquiries are welcomed about interdisciplinary topics and post-M.A. study that may be undertaken in co-operation with other departments and institutes in the University, such as the School of International Affairs, the Institute of Canadian Studies and the Ottawa-Carleton Centre for Geoscience Studies.

The program of study for each student is based on the interests of the individual. An advisory committee, consisting of the student's research supervisor and at least two other members of the department, is set up to monitor and provide guidance for the student's research. The department has excellent laboratory facilities for the geotechnical study of near surface processes, and the physics, chemistry, and thermodynamics of earth materials. There is a large map library and a well-equipped cartography laboratory as well as mini-computers, plotters and a digitizer. These facilities are supported by a highly qualified full-time staff in laboratory instrumentation, cartography, and data processing. The location of the University in the nation's capital offers the student access to important federal resources, such as the National Library, the National Archives, other specialized government libraries and Statistics Canada.

Currently, the main areas of specialization in the department are the following:

Physical Geography and Geotechnical Science

Studies of natural processes close to earth's surface, especially as they apply to environmental management: climate-ground interaction, micro-meteorology in frozen ground regions, the chemical, physical, and thermodynamic properties of soils and sediments, and hydrology and sedimentology of fluvial processes in glacial and periglacial environments. Current emphasis in investigations of geotechnical concern are cold region phenomena, soil-water relations, and stability of marine clays.

(J.P. Johnson, M.W. Smith, J.K. Torrance, T.P. Wilkinson, P.J. Williams)

Rural and Resource Development

Identification of development processes; the interplay of population, political, demographic, and socioeconomic variables with land resources, physical environment resource-based industries, and

spatial factors. Northern development, rural-urban evolution in developing countries, tropical, agricultural, and recreational land use are of particular interest.

(D.M. Anderson, J.P. Johnson, D.B. Knight, M.W. Smith, D.R.F. Taylor, J.K. Torrance, A.I. Wallace)

Cultural, Historical, and Political Geography

The effect of cultural attitudes and techniques on the evolution of human groups, their organization of earth's space and resources in past and present landscapes; territorial organization and the concepts of state, territoriality and self-determination; role of territory in conflict situations; the role of political and religious authority and ideology in changing the physical environment; concepts of territory and territoriality; and perception of the environment and settlement history; urban conservation.

(John Clarke, D.B. Knight, D.R.F. Taylor, J.E. Tunbridge)

Economic and Urban Geography

Identification of basic spatial regularities in the socioeconomic organization of human activity. Spatial decision making and spatial dynamics as exemplified in the internal structure of urban places, industrial location, regional organization, and characteristics of transport systems.

(David Bennett, D.M. Ray, J.E. Tunbridge, A.I. Wallace)

Computer-Assisted Cartography and Remote Sensing

Research and course work in both computer cartography and the application of remote sensing to the solution of geographical problems is available within the department.

(M.F. Fox, D.R.F. Taylor, J.P. Johnson, T.P. Wilkinson)

The opportunity for wider experience in cartography may be obtained through arrangements by which a student may take for credit at Carleton University one or more courses in cartography offered by the Department of Geography, Queen's University. The principal areas of focus are map design and history of cartography at Queen's, and applied aspects of computer-assisted cartography at Carleton.

Students following the co-operative cartography program may register in either department, and will follow the normal regulations and requirements of their university of registration. When appropriate for students in the co-operative program, representatives from both universities may be members of a student's thesis examining board.

Financial aid for transport between cities will be provided by the home department.

Systematic interests of departmental members are applied to regions of special interest: Africa (Knight, Taylor); Southwest Pacific (Knight); Arctic and Subarctic (Smith, Johnson, Williams); Canada (Anderson, Clarke, Wallace, Knight).

Qualifying-Year Program

Applicants with exceptional promise who have a general (pass) bachelor's degree, or who have substantially less than the honours B.A. in Geography may be admitted to a qualifying-year program. To be considered for admission into the master's program, qualifying-year students must attain at least an overall high second-class standing in their qualifying-year geography courses. The general section of this calendar provides details about the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission into the master's program is an honours B.A. or B.Sc. in Geography with at least high second-class standing. Applicants who have taken their undergraduate degree in the physical or natural sciences or engineering, as well as in physical geography, will be considered if their research interest coincides with those of the department. Applicants in human geography may be accepted from related fields if their proposed research is closely related to faculty research experience. Students with academic deficiencies may be required to take additional courses.

Program Requirements

The M.A. in Geography is expected to take 12 months, but field work may necessitate some extension. All master's students in geography are required to complete a minimum of five full-courses or the equivalent, including an M.A. thesis (equivalent to two full-courses) which must be successfully defended at an oral examination. All students are required to have a reading knowledge of the language considered essential to their research.

Graduate Courses*

In addition to the selection of courses offered by the department, graduate students in geography are encouraged to consider, in partial fulfilment of their degree requirements, appropriate courses offered in such disciplines as biology, chemistry, economics, engineering, geology, history, international affairs, physics, political science, and sociology.

Courses at the University of Ottawa may also be taken for credit in a Carleton M.A. program; permission of departments in both universities is required.

The following courses, normally offered annually, are tentatively scheduled for 1985-86:

- Geography 45.500F1

Graduate Research Seminar

A review of competing philosophies in geography, and an analysis of the research implications of particular theories of knowledge including the application of scientific principles of investigation to contemporary research in geography.

David Bennett.

- Geography 45.517F1, W1, S1

Field Study and Methodological Research

Field acquisition and analysis of geographic material; supervised field observations and methodology. (Individual or group basis, by special arrangement.)

Co-ordinator: Supervisor of Graduate Studies.

- Geography 45.520W1

Problems of Development in Africa

The problems facing developing nations today, with emphasis on their spatial aspects. Examples will be drawn from African nations.

(Also offered as International Affairs 46.563)

D.R.F. Taylor.

- Geography 45.532F1

Soil Thermal and Hydrologic Properties

Instrumental techniques for investigation of hydrological and thermal processes near the earth's surface, laboratory instrumentation, and analysis of laboratory and field procedures in geotechnical science.

(Alternates with Geography 45.530)

P.J. Williams.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

● Geography 45.533W1

Periglacial Geomorphology

Permafrost, its distribution and significance, seasonal ground freezing, ground thermal regime, physical, thermodynamic, and geotechnical properties of freezing and thawing soils, terrain features ascribable to frost action, and solifluction and patterned ground.

P.J. Williams.

● Geography 45.534W1

Aspects of Clay Mineralogy and Soil Chemistry

The role of clay minerals in soils will be considered from a geotechnical and/or biological perspective.

J.K. Torrance.

● Geography 45.537W1

Soil Resources

The properties of soils; development, classification, productive potential, and management problems of the world's soils. Primary emphasis will be agricultural, but environmental and geotechnical aspects will be considered.

J.K. Torrance.

● Geography 45.540F1

Territory and Territoriality

Evolution of the Western meaning of territory is examined against contrasting contemporary concepts in the Third World, especially Africa. Significance of territory and territoriality: their impact on restructuring of political space, territorial claims, self determination, conflict, and processes of development.

(Also offered as International Affairs 46.542)

D.B. Knight.

● Geography 45.543F1

Selected Concepts in Cultural Geography

In 1985-86 the primary focus will be the geographical dimensions of selected plural societies.

● Geography 45.545

Problems in Historical Geography

Philosophical and methodological approaches in geography, history, and historical geography, emphasizing the use of primary documents, model building and statistical methods as they relate to the historical geography of Canada.

John Clarke.

● Geography 45.550F1

Spatial Dynamics of Urban and Regional Systems I

A review of recent theoretical and methodological debate in the field, followed by concentration on city-system development, the behaviour of multi-locational enterprises, and the nature of regional economic disparities and policy responses.

● Geography 45.551F1

Spatial Dynamics of Urban and Regional Systems II

An approach to the analysis of urban and regional system behaviour, embodying theoretical insights and research methodologies based on general systems theory and its applications.

D.M. Ray.

● Geography 45.555W1

Tourism and International Development

The nature and effect of tourist development in various parts of the world, and the role of tourism in developed and developing countries.

G.D. Taylor.

● Geography 45.570W1

Problems of Development in Arctic and Subarctic Environments

Research seminar on specific problems in Canada's northland. Experience from other parts of the world will be incorporated when appropriate.

J.P. Johnson.

● Geography 45.572W1

Issues in Canadian Resource Development

An overview of Canadian natural resource problems and prospects, concentrating on agriculture, forestry, energy, minerals, and offshore resources.

A.I. Wallace.

● Geography 45.579F1

Research and Development in Outdoor Recreational Geography

Developments and research in Canadian recreational land use: trends and patterns, supply and user preferences, impacts, wilderness recreation, landscape classification, and park system planning and management.

D.M. Anderson.

● Geography 45.580W1

Spatial Information Systems and Computer Cartography

The concepts and problems involved with spatial information systems, especially those with a mapping component.

Gordon Decker.

● Geography 45.581

Seminar in Map Design

A seminar on selected problems in the design, construction, and appreciation of maps.

(Offered at Queen's University as 38.850)

● Geography 45.582

Seminar in Historical Cartography

A seminar on selected problems in historical cartography.

(Offered at Queen's University as 38.877)

- Geography 45.590F1, W1, S1

Graduate-Tutorial

Tutorial, directed reading or research, offered on an individual basis, to meet specific program needs; may be taken in one of the areas of specialization of the department.

Co-ordinator: Supervisor of Graduate Studies.

- Geography 45.599F4, W4, S4

M.A. Thesis

Thesis supervision will be given in all areas of specialization of the department, as listed in the calendar section identifying departmental specializations.

Co-ordinator: Supervisor of Graduate Studies.

Courses Not Offered in 1985-86

- 45.530 Soil Thermal and Hydrologic Properties
- 45.536 Floating Ice Studies
- 45.546 Geographical Insights to Canadian Problems

The Norman Paterson School of International Affairs

The School

Director of the School: B. W. Tomlin

Associate Director: D. B. Knight

The Norman Paterson School of International Affairs, established in 1965 with the generous support of the Honourable Norman M. Paterson, offers a program of studies leading to the M.A. degree.

The program focuses on three themes: global and regional political economy, development studies, and conflict analysis. The program affords students the opportunity to focus on Canada in international affairs through specialized courses related to each of these themes. The program also allows students to focus on international management issues relevant to governmental and non-governmental organizations and international enterprise. Attention is also paid to the role of international institutions, the foreign policies of other countries, and to selected regional studies. The school maintains close co-operation with the Institute of Soviet and East European Studies, and with committees designed to encourage and co-ordinate faculty and student interests in Africa, Asia, and Latin America.

A specialized resource centre is located in the school and is staffed by a full-time information specialist. Students and faculty have access to a broad range of current bibliographic materials, using the resources of the national capital area as well as on-line computerized bibliographic services in foreign policy and international affairs. The school also participates in the Social Science Data Archives at Carleton, and students have access to a full range of data sets available from the Inter-University Consortium for Political Research, as well as the Canadian Institute of Public Opinion poll data and the Human Relations Area Files.

Qualifying-Year Program

Admission Requirements

The qualifying-year program is designed to enable students with at least high second-class standing, but with an inadequate background in the disciplines relevant to the M.A. program, to make up deficiencies. Candidates with a general (pass) bachelor's degree, in a discipline closely related to international affairs, will be required to take five qualifying-year courses before being eligible to enter the master's

program. Those with an honours bachelor's degree in an unrelated discipline may be required to take at least three qualifying-year courses before being eligible to enter the master's program.

Students in the qualifying year are encouraged to select a core theme. They may also wish to select an area emphasis and to take courses that will enable them, in the M.A. year, to engage in specialized study in the problems of a region having particular relevance to the core theme they have elected. Students should also take appropriate courses in order to prepare them to fulfil the language requirements of the M.A. program.

Under current practice, students are expected to achieve a high second-class standing in qualifying-year courses in order to be admitted to the M.A. program.

Program Requirements

Global and Regional Political Economy

The following courses are recommended: Economics 43.360 or 43.361 and 43.362 (half-courses), and Political Science 47.360 and 47.361 (half-courses), or 47.460.

Development Studies

The following courses will normally be required: Economics 43.360 or 43.361 and 43.363 (half-courses), and at least one course in geography, political science, or sociology and anthropology relevant to this theme. Particularly recommended are courses on one of the developing regions: Geography 45.330, 45.331, 45.332 and 45.380 (half-courses); Political Science 47.310, 47.315, or 47.414, 47.415; Anthropology 54.230, and Sociology 53.360.

Conflict Analysis

The following courses are recommended: History 24.380, 24.480 or 24.481; Law 51.463; Political Science 47.361 and 47.365 (half-courses) and 47.270 and 47.460; and Sociology 53.306 and 53.358. Also recommended are courses dealing with other approaches to conflict or with regions in which the student may wish to apply conflict theory.

Master of Arts

Admission Requirements

The minimum requirement for admission into the master's program is an honours bachelor's degree in a discipline related to international affairs. Under

current practice, at least a high second-class standing is normally required for consideration for admission to the program.

Students may wish to provide scores on the Graduate Record Examination aptitude test in order to assist the admissions committee.

The Faculty of Graduate Studies and Research requires applicants whose native tongue is not English to be tested for proficiency in English, as described in the application for admission section, page 12 of the general regulations in this calendar.

Candidates who lack the required background in international affairs will be expected to complete a maximum of two additional courses. Core seminar requirements are listed under program requirements for qualifying year.

Students admitted to the international development core are strongly encouraged to take an undergraduate half-course in development economics before beginning the M.A. program in September. Students admitted to the global and regional political economy core are strongly encouraged to take an undergraduate half-course in international economics before beginning their programs in September. Otherwise, these requirements (additional to the M.A.) will have to be taken simultaneously with the M.A. program, and may result in some delay in its completion.

Program Requirements

The normal program requirements for M.A. students in international affairs are:

- One interdisciplinary core seminar or equivalent selected from the following:

International Affairs

46.500 Global and Regional Political Economy

46.505-46.508 Development Studies (two must be selected)

46.515 Conflict Analysis

- Two other approved courses (or the equivalent) in international affairs or related disciplines, if a student elects to write a thesis.
- Three other approved courses (or the equivalent) in international affairs or related disciplines, if a student elects to write a research essay
- A thesis (valued at two credits) or a research essay (valued at one credit) involving original research on an approved subject in the field of international affairs
- An ability to read a second major international language, or a language appropriate to a student's major research interest
- An oral comprehensive examination, primarily on the thesis or research essay and core seminar, to determine the candidate's ability to relate various disciplines to the study of international affairs.

English-speaking Canadian students are expected to develop proficiency in French.

Canadian Concentration

Students may elect to include a Canadian concentration as part of their program. This concentration shall include:

- one of the three interdisciplinary core seminars or equivalent
- one of International Affairs 46.511, 46.512, 46.513
- A thesis or a research essay on a Canadian theme.

Candidates who lack the required background in the study of Canada's international policy will be required to complete International Affairs 46.510.

International Management Concentration

Students may elect to include international management as part of their program in the school. This concentration will be of particular interest to students who wish to pursue careers in international governmental and non-governmental organizations, international banking or international enterprise. The concentration will be designed in consultation with a faculty co-ordinator.

The concentration shall include:

- one of the three interdisciplinary core seminars or equivalent
- at least two courses chosen from among the following list: 46.530, 46.531, 46.532, 46.533, 46.535, 46.539, 46.541, 46.557, 46.569
- students may also choose courses from among those offered by the School of Business or the School of Public Administration
- a thesis or a research essay on an international management topic.

Students interested in the International Management Concentration are strongly encouraged to complete prerequisites in accounting and international economics before beginning their M.A. program. Candidates who lack background in these prerequisites will be required to take the appropriate courses as part of the M.A.

Academic Standing

A grade of B- or better must be obtained in each course credited towards the master's degree. The school does not permit exceptions to this rule.

Career Planning

Students interested in continuing to doctoral programs should plan their programs to include courses in their discipline, if other than international affairs, which may be deemed necessary for their

admission to doctoral programs. Interdisciplinary doctoral programs in international affairs are given in a number of institutions and the faculty can provide guidance in planning for these programs.

Recent experiences of students show that a strong background in research methods and economics enhances job placement, and students may wish to take this into account in planning their course program.

School faculty can provide advice on careers in government, international governmental and non-governmental organizations, and in the private sector.

Graduate Courses*

Part-time students are permitted to enrol in a maximum of two half-courses per term.

Core Seminars

● International Affairs 46.500T2

Global and Regional Political Economy
A study of global political economy, with emphasis on its historical development, regional integration, and contemporary institutional structures.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

● International Affairs 46.505F1

International Dimensions in Development Studies
Issues in development financing, international trade, industrialization and technology transfer, food and natural resources, and the role of international organizations.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

● International Affairs 46.506W1

Agriculture and Rural Development
A study of the agricultural sector, rural areas, and rural welfare in developing countries, including consideration of structural change in agriculture, agrarian reform, rural development strategies in various countries, and public policies affecting agriculture, activities ancillary to agriculture, rural industry, and public services.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

● International Affairs 46.507F1

Theories of Development and Underdevelopment
A comparative analysis of approaches to the study of development processes and underdevelopment, including structural-functional, neo-classical, Marxist, and dependency theories.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

● International Affairs 46.508W1

Development Planning: Theory and Practice
Third World development plans and strategies and their impacts; techniques employed in development planning, including social cost-benefit analysis, budgeting, and problems in development administration.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

Students electing development studies as their core seminar will be required to complete two of the above courses numbered 46.505-46.508.

● International Affairs 46.515T2

Conflict Analysis
A study of contemporary theories of international conflict and conflict regulation, negotiations and bargaining.

Prerequisite: M.A. standing in the Norman Paterson School of International Affairs or permission of the school.

Canadian Concentration

● International Affairs 46.510F1

Development of Canada's International Relations
A review of economic, political, and sociocultural factors in Canada's international relations and in the development of its policies.

● International Affairs 46.511W1

Canada in the International Political Economy
Analysis and evaluation of Canada's relationships and policies within the context of the global and regional political economy.

Prerequisite: Enrolment in International Affairs 46.500 or permission of the school.

● International Affairs 46.512W1

Canada and International Development
Analysis and evaluation of Canada's policies and programs with respect to international development.

Prerequisite: Enrolment in two of International Affairs 46.505-46.508, or permission of the school.

- International Affairs 46.513W1
Canada and International Conflict
Analysis and evaluation of Canada with respect to international conflict and conflict resolution.
Prerequisite: Enrolment in International Affairs 46.515 or permission of the school.

Other Courses

- International Affairs 46.520F1
Studies in Strategy and Security
Selected topics in strategic theory and practice.
- International Affairs 46.521W1
Studies in Strategy and Security
Selected topics in strategic theory and practice.
- International Affairs 46.527
Conflict in the Middle East
- International Affairs 46.529
Conflict in Southern Africa
- International Affairs 46.530F1
International Enterprise
This course is designed to give the student an appreciation of recent economic and political developments in the fields of international trade and investment as they relate to the operations of international enterprises. The course will develop concepts and analytical approaches and provide examples in order to examine the impact of international enterprises on international affairs.
- International Affairs 46.531W1
International Industries
This course will develop a framework for describing and analyzing international industries. A number of industries will be examined. Issues to be discussed will include producer country associations, codes of conduct and guidelines, concession agreements and expropriations, country risk analysis and international collective bargaining.
- International Affairs 46.532F1
Science, Technology and International Affairs:
The Advanced, Industrial Countries
This seminar analyzes the process of technological change since the industrial revolution and examines its consequences for development in the advanced industrial countries and for relations among these countries.
- International Affairs 46.533W1
Science, Technology and International Affairs:
The Third World
This seminar focuses upon the problem of building indigenous technological capabilities in the Third World. It examines the role of MNCs in the transfer of technology, the generation of appropriate technologies locally and the role of the state in the formulation of technology policy for development.

Technological co-operation among Third World countries may also be discussed.

- International Affairs 46.535
International Bargaining and Negotiation: Theory and Practice
An examination of bargaining and negotiation in international economic, political and security issue areas, emphasizing case studies as well as theoretical analysis.
- International Affairs 46.536
The Third World in the Global Political Economic System
The seminar will examine inter-state relations within the Third World as they interact with the global political economic system. Particular attention will be paid to the emergent role of the Arab/OPEC grouping. Among the topics discussed will be the ideologies and leadership roles in the Third World, the international dimensions of Islamic revivalism, contending perspectives on human rights in development, Third World militarization, and the ramifications of war in the Third World for international development and security. Each year the seminar will focus on specific issues and themes.
- International Affairs 46.537
Macroeconomics in a Development Context
An examination of macroeconomic theory and policy in the context of the developing countries, with special emphasis upon theory and policy for open economies, structural adjustment to international disequilibrium, exchange rate and balance of payments management, fiscal and financial policy.
- International Affairs 46.538F1
International Economics: Policy and Theory
An overview of international finance, trade, investment, and international aspects of economic development. Emphasis will be placed on policy analysis and the underlying institutional context.
- International Affairs 46.539W1
International Financial and Monetary Institutions and Policy
A selective, in-depth review of issues such as balance of payments, adjustment processes, and the role of international financial and monetary institutions.
- International Affairs 46.540S1
International Development and International Organizations
A critical analysis of the roles played by the UN and other international organizations in the design, promotion and execution of international development policies and programs.

● International Affairs 46.541

The International Economics and Politics of Resources

An examination of resource-related issues in the international system, focusing on energy, non-fuel mineral and agricultural areas.

● International Affairs 46.542W1

Territory and Territoriality

Evolution of the Western meaning of territory is examined against contrasting contemporary concepts in the Third World, especially Africa. Significance of territory and territoriality: their impact on restructuring of political space, territorial claims, self-determination, conflict and processes of development.

(Also offered as Geography 45.540)

● International Affairs 46.543S1

Future of the International System

Future trends in the international system, emphasizing the impact of science and technology, changes in economic patterns and in communications. Future policy options for Canada in a changing international system.

● International Affairs 46.549F1, W1, S1

Selected Topics in International Affairs

● International Affairs 46.557

International Economic Law: Regulation of Trade and Investment

A study of selected problems associated with the regulation of international economic activity. The seminars will focus on a discussion of relevant international institutions (GATT, UNCTAD, IMF, World Bank), an introduction to the legal aspects of integration (e.g. EEC, ASEAN), governmental regulation of trade and investment (e.g. FIRA), and the problem of extraterritoriality.

Prerequisite: Open only to graduate students in their Master's year who have not previously studied international economic law.

(Also offered as Law 51.520)

● International Affairs 46.560

Human Resource Development

An analysis of theory and policy regarding some of the major areas of human development in the developing areas, including demography and population, education, public health, nutrition, women and development, social security, employment, and manpower planning.

● International Affairs 46.561

Historical Dimensions of Development and Underdevelopment

Comparative studies in the economic and social history of selected developed and developing coun-

tries. The aim is to identify conditions which have fostered or inhibited development in the past, and thereby to assess contemporary development strategies in the light of historical experience.

● International Affairs 46.562W1

Ethical and Cultural Dimensions in Development Studies

Exploration of concepts of value, rights, duties, law, and obligation in relation to global development issues. Comparative analysis of major ideological and ethical foundations of regional cultures, and the problems for cross-cultural and transnational relations.

● International Affairs 46.563

Problems of Development in Africa

(Also offered as Geography 45.520)

● International Affairs 46.564F1

Problems of Development in Latin America

An examination of Latin America's principal developmental trends, problems and policies, as they have evolved during the past three decades. Emphasis will be given to the design and implementation of alternative development strategies through the remainder of the century.

● International Affairs 46.567

Development in South East Asia

A comparative analysis of political and economic development in selected South East Asian countries, with particular attention to Indonesia, Malaysia, Thailand and Burma. Major issues to be studied include the process of political and social change, the emergence of contemporary economic systems, the evolution of development policies and planning and their impact on agriculture and rural development, education, industrialization and trade expansion.

● International Affairs 46.569

Social Cost-Benefit Analysis and Development Project Evaluation

An examination of social cost-benefit analysis and project evaluation in the context of the developing countries, emphasizing applied case studies as well as theoretical analysis.

● International Affairs 46.580

Pacific Economic and Political Relationships

A course on the nature and prospects of the Pacific basin economy. The main topics will include a review of the record of outward-oriented development strategies of Japan, Korea, Taiwan, Hong Kong and ASEAN; the economics and politics of U.S.-Japan relations and the prospects of China's participation in Pacific trade and development. Canada's economic and political interests in Pacific co-operation will also be studied. Attention will be

paid to the prospects for regional institutional arrangements as well as bilateral links.

- International Affairs 46.581W1
Regional Co-operation Among Developing Countries

A comparative study of selected regional co-operation or integration schemes, including some or all of the East African Community, the Economic Community of West African States, Central American Common Market, CARICOM, the Andean Group, and the Association of South East Asian Nations.

- International Affairs 46.582W1
The Political Economy of East-West Relations
Seminar designed to deepen students' understanding of the interaction of politics and economics in East-West relations. Topics include: the forms and impact of technology transfer, the role of multinationals, the problems of indebtedness, the effectiveness of controls and sanctions and the growth of energy interdependence. Special attention paid to Canada's position and experience in East-West relations.

- International Affairs 46.583W1
Political Economy of Eastern Europe
An examination of the Soviet-East European economic, political, ideological and military relations, of economic integration, of international relations in the region, and of the role of East-West co-operation.

- International Affairs 46.588W1
International Political Economy
A seminar on the changing international division of labour and its consequences for world politics. Topics include differing patterns of industrialization, colonial relations, the role of the state, and current issues in international political economy.
Prerequisite: Work at a senior undergraduate level is required in at least two of the following: international relations, development studies, international trade, or political economy (or permission of the school).
(Also offered as Political Science 47.588)

- International Affairs 46.591F1, W1, S1
Tutorials in International Affairs
To be chosen in consultation with the director.

- International Affairs 46.595F1, W1, S1
Research Workshop
This seminar focuses on the special problems of research design in the interdisciplinary field of international affairs, with materials drawn from both the established literature and the practice of leading members of the school's faculty.

- International Affairs 46.598F2, W2, S2
Research Essay

- International Affairs 46.599F4, W4, S4
M.A. Thesis

Selection of Courses

In addition to the graduate courses offered in the school, qualified students may choose from among courses in international affairs offered by related departments, schools and institutes.

Department of Law

The Department

Chairman of the Department: Dorothea Wayand

Director of the Jurisprudence Centre: C.N. Sargent

Although the Department of Law does not offer a program of studies leading to an M.A. degree in Law, it actively participates in such interdisciplinary graduate programs as those offered by the Norman Paterson School of International Affairs, the Institute of Canadian Studies, and the School of Public Administration. Members of the department also supervise graduate theses and research essays, and provide graduate-level tutorials dealing with the legal aspects of various disciplines.

The Jurisprudence Centre, established by the department in 1974, is a forum for the advanced interdisciplinary study of problems related to law, law reform, and policy.

Currently, the Department of Law offers six courses at the graduate level.

A number of courses offered by the department at the senior undergraduate level form part of certain interdisciplinary graduate programs in such areas as public administration, international affairs, Canadian studies, and Soviet and East European studies. These courses are described in the undergraduate calendar.

Graduate Courses*

• Law 51.510F1

Advanced Problems in Legal Philosophy
Studies in legal theory and analyses of law advanced by Hart, Dworkin, and others; legal concepts: for example, principles, rights, duties, liability, etc. Precise course content will vary from year to year and will be announced at the beginning of the term.

Prerequisites: Either Law 51.315, or 51.311 (32.311) and 51.312, or permission of the department.
(Also offered as Philosophy 32.510)
P.J. Fitzgerald and R.R.A. Marlin.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Law 51.520

International Economic Law: Regulation of Trade and Investment

A study of selected problems associated with the regulation of international economic activity. The seminars will focus on a discussion of relevant international institutions (GATT, UNCTAD, IMF, World Bank), an introduction to the legal aspects of integration (e.g. EEC, ASEAN), governmental regulation of trade and investment (e.g. FIRA), and the problem of extraterritoriality.

Prerequisite: Open only to graduate students in their master's year who have not previously studied international economic law.

(Also offered as International Affairs 46.557)

• Law 51.550F1

The Canadian Constitution

A highly concentrated half-course, designed to familiarize graduate students with the terminology, principles, and doctrines of judicial interpretation of the *Constitution Acts 1867-1982* and other constitutional statutes. The emphasis will be on the division of legislative powers in the Canadian federation. This course or its equivalent is a prerequisite for the course Law 51.553: Advanced Legal Problems of Federalism.

Prerequisite: Open only to graduate students in their master's year who have not previously studied Canadian constitutional law. Graduate students at the qualifying-year level are advised to consider registering in Law 51.450: Canadian Constitutional Law.
J.G. Neuspiel.

• Law 51.553W1

Advanced Legal Problems of Federalism

An advanced study of selected Canadian constitutional problems including constitutional revision. Some comparisons with other federal systems may be made.

Prerequisite: A course in basic Canadian constitutional law, for example Law 51.550, or permission of the department.
J.G. Neuspiel and others.

• Law 51.590T2

Tutorials/Directed Readings in Law

Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor. A substantial requirement for the course may be participation in an advanced law course at the undergraduate level.

- Law 51.591F1, W1, S1

Tutorials/Directed Readings in Law

Tutorials or directed readings in selected areas of law, involving presentation of papers as the basis for discussion with the tutor. A substantial requirement for this course may be participation in an advanced law course at the undergraduate level.

Courses Not Offered in 1985-86

51.556 Advanced Administrative Law Problems

51.563 International Law

51.567 Advanced International Legal Problems

Department of Political Science

The Department

Chairman of the Department: Harald von Riekhoff

Departmental Supervisor of Graduate Studies:

M.B. Dolan

Assistant Supervisor: To be announced

The department offers programs leading to the M.A. and Ph.D. degrees. Specialized graduate study and research may be undertaken in the fields of political theory, Canadian government and politics, comparative government and politics, international relations, and public administration and policy analysis. Within these fields, students may select more specialized areas of concentration, such as classical, medieval and modern, or analytic and empirical theory; comparative government, and politics of a particular area or group of countries, such as Africa, Eastern Europe, or South and East Asia where the department has developed particular strength and resource materials.

Ottawa provides a wealth of resources, both in personnel and in research material, for the student of government, politics, public administration, and international relations. Carleton has specialized schools and institutes in interdisciplinary study in public administration, Canadian studies, international affairs, and Soviet and East European studies. In addition to the University facilities, Ottawa offers the graduate student in political science a host of study and research opportunities unparalleled in Canada. The Public Archives, the National Library, the Library of Parliament, the Supreme Court Library, the National Museums, and Statistics Canada are all located in Ottawa. The headquarters of many government departments, most federal government agencies, and a multitude of national organizations and trade associations are located in Ottawa; many maintain specialized libraries. Some of the embassies and diplomatic missions located in Ottawa maintain specialized libraries, and offer access to documents and other research materials.

Qualifying-Year Program

Applicants who have a general (pass) B.A. in Political Science, with second-class standing, may be considered for admission to a qualifying-year program. Candidates who complete the qualifying year with high second-class standing may be considered

for admission to the master's program the following year.

Refer to the general section of this calendar for details of the regulations governing the qualifying year.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is an honours B.A. (or the equivalent) in Political Science, with at least high second-class standing.

Honours graduates in fields other than political science will be considered on the basis of their academic background and standing. Those with deficiencies may be required to take additional courses or to register in the qualifying-year program.

Program Requirements

All master's candidates will enrol in an approved number of courses in political science, including political theory and research methodology, if not already taken. No more than one of these courses may be taken at the 400 level.

Each candidate, in consultation with the department, will select and follow one of the following three optional program patterns:

- Five full courses (or the equivalent) in political science
- Four full courses (or the equivalent) in political science, and a research essay on a topic related to one of the courses
- Three full courses (or the equivalent) in political science, and a research thesis, equivalent to two full courses, in an approved field.

All master's candidates in political science must also undertake comprehensive examinations on approved fields. Details of these examinations are outlined in the section on comprehensive examinations.

All candidates must normally demonstrate a reading knowledge of French. Students from abroad, whose mother tongue is other than English, or students whose research interests require another language, may obtain permission from the departmental graduate studies committee to substitute this language for French. Language tests are conducted twice a year, in October and February.

A supervisor will be assigned to each candidate to advise and assist in the preparation for the comprehensive and language examinations.

Comprehensive Examinations

Those master's candidates electing a five-course program will be required to take a comprehensive examination, orally or in writing, on an approved major and allied field. The major field of concentration will be chosen from the following:

- Political Theory
- Canadian Government and Politics
- Comparative Government and Politics
- International Relations
- Public Administration and Policy Analysis

Comprehensive examinations normally will be undertaken no later than the term immediately following the completion of course work for the master's degree. Those master's candidates electing the four-course plus research essay, or three-course plus thesis options, will be required to defend the essay or thesis at an oral examination. This examination may include material related to the general field of the essay or thesis.

Academic Standing

All master's candidates must obtain at least B standing (grade point average of 8.0). One grade of C+ may be allowed.

Doctor of Philosophy

The Ph.D. program in political science normally will be undertaken on a full-time basis. However, in cases of exceptional merit, the department will accept a few candidates for the degree on a part-time basis.

Admission Requirements

The normal requirement for admission to the Ph.D. program is a master's degree (or its equivalent) in political science, public administration, or international affairs, with at least high second-class standing. This normally will mean a Carleton equivalent grade point average of 9.5, taking into account both transcript and letters of reference.

Program Requirements

The normal program requirements for Ph.D. candidates are outlined in the general regulations section of this calendar.

All students are required to have or to acquire an adequate basic knowledge of political theory and research methodology, regardless of their field of specialization. They will also be expected to undertake further work in statistics, if statistical proficiency is needed for the preparation of the thesis.

The specific program requirements for Ph.D. candidates in political science are the following:

- At least three graduate full courses (or the equivalent); a grade point average of at least 9.0 must be obtained in these courses before proceeding to the comprehensive examinations. Additional courses may be required for candidates whose background or standing is deficient. Students are encouraged to take additional courses for credit or audit, beyond the minimum requirement of three, in order to prepare for comprehensive examinations in areas of specialization in each of their fields.
- Program options for Ph.D. field selections: *either* two major fields with two subfields in each, *or* a major field with two subfields and two minor fields with a subfield in each; that is, a choice of one of two program options: Political Science 47.690 and 47.695, *or* Political Science 47.690, 47.691, and 47.692.
- Proficiency in languages and/or research skills, as outlined below under language and research skill requirement
- Comprehensive examinations, as outlined below under comprehensive examinations
- A thesis, written in English or French, which must be defended in English at an oral examination; this examination may include material related to the general field of the thesis.

The completion of the Ph.D. program will normally require at least two years of full-time study beyond the master's degree.

A supervisor and at least two other advisers will be assigned to each Ph.D. candidate to advise him/her on his/her studies. The student's entire program must be approved by the department.

Language and Research Skill Requirement

All Ph.D. candidates must demonstrate an ability to use two research skills appropriate to their program, one of which must be a language other than English.

Candidates, one of whose fields is Canadian government and politics, or whose thesis deals mainly with Canada, must demonstrate an ability to read and translate French easily as one of their skill requirements.

All other candidates must demonstrate an ability to read and translate easily a language appropriate to their program.

The second skill requirement may be fulfilled in one of the following ways:

- A demonstrated ability to read and translate easily a second language
- An oral knowledge of a language sufficient to conduct interviews in the language

- Satisfactory completion (B – or better) of *two* of Political Science 47.571: Research Design; Political Science 47.572: Applied Research Methods; Political Science 47.573: Advanced Research Methods.
- Credit work in an approved political science methodology workshop or colloquium.

The research skill requirement shall *normally* be satisfied before the thesis proposal defence.

Comprehensive Examinations

All Ph.D. candidates must select one of the two options below:

- A written examination in two major fields covering general knowledge of the field; examination in two approved areas of specialization in each field, the form of examination to be determined by the supervisory committee in conjunction with the supervisor of graduate studies.
- A written examination in one major field covering general knowledge of the field, and examinations in two approved areas of specialization; a written general examination in two minor fields, and examination in one approved area of specialization in each. The form of examination in areas of specialization will be determined by the supervisory committee in conjunction with the supervisor of graduate studies.

In addition, candidates must undertake a final oral comprehensive examination integrating the fields.

The comprehensive examinations will normally be completed by the beginning of the seventh term of registration. Candidates will be expected to complete these examinations successfully before beginning the thesis. The fields of study for the Ph.D. examinations are to be chosen from the following list:

Political Theory

A general knowledge of the main outlines and significant themes and problems of political philosophy and thought, with emphasis on two of the following: classical (mainly Greek and Roman); modern (Machiavelli through the nineteenth century); contemporary (twentieth century); Canadian and American political thought and its immediate European background; current theories and approaches to political analysis; methodology and theory construction.

Canadian Government and Politics

A general knowledge of Canadian political ideas, institutions, and processes, with emphasis on two of the following: federalism and the constitution; parliament and legislatures; parties, elections, and interest groups; political culture and socialization; political economy; provincial government and politics; local government and politics; public administration (if not

chosen as a subfield under public administration and policy analysis); public policy and policy analysis; foreign policy and relations (if Canada is not chosen as the particular state under international relations); Canadian political thought and ideology (if not chosen as a subfield under political theory).

Comparative Government and Politics

A general knowledge of the theories and methodology of comparative politics, with emphasis on one subfield from each of the following two lists:

- Countries or areas: Western Europe; USSR and/or Eastern Europe; United States; Africa; or an approved combination of countries or areas.
- Topics or themes: political development and integration; political stability and change; federalism; legislatures; local government and politics; multiculturalism and the politics of ethnicity; political parties and interest groups; public opinion and voting behaviour; policy analysis.

International Relations

A general knowledge of international theory, international organization, and the development of the field of international relations, with specialization in two of the following: analytical international theory; Canadian foreign policy (if this subfield is not chosen in Canadian government and politics); comparative analysis of foreign policy (including a knowledge of a particular state or region); international integration and organization; conflict and conflict resolution (including arms control and international negotiation); international political economy.

Public Administration and Policy Analysis

A general knowledge of theory and of practice in Canada, Britain, and the United States, with emphasis on two of the following topics: 1. theories of administration, organization, comparison, and policy analysis; 2. Canadian public administration (including some knowledge of provincial and municipal levels); 3. Canadian public policy and policy analysis (including some knowledge of provincial and municipal levels); 4. comparative public administration (with reference to developed or developing countries, or an approved combination of countries); 5. comparative public policy and policy analysis (with reference to developed or developing countries or an approved combination of countries); 6. administrative responsibility (including judicial controls).

Candidates may not select both subfields 2 and 3 and may not select any of subfields 2, 3, or 4 in combination with the corresponding subfields in the main fields of Canadian Government and Politics and Comparative Government and Politics. For example, a candidate may not select the Canadian subfield "public administration" and the Public Administration subfield "Canadian public administration".

Selection of Courses

Within the scope of the regulations, the following undergraduate courses (fully described in the *Carleton University Undergraduate Calendar*) may be taken by graduate students.

Please note that all of these courses are not offered every year. Students should consult the timetable published each year in early June.

Political Science

- 47.400 Topics in Canadian Government and Politics
- 47.401 Canadian Public Policy
- 47.402 Policy Seminar: Problems of Northern Development
- 47.403 Politics and the Media
- 47.404 Interest Groups in Canadian Politics
- 47.405 Federalism
- 47.406 Legislative Process in Canada
- 47.407 The Politics of Law Enforcement in Canada
- 47.408 National Security and Intelligence in the Modern State
- 47.409 Politics in Quebec
- 47.410 Canadian and Comparative Local Government and Politics
- 47.411 French-English Relations
- 47.412 Society and Politics in Liberal Democracies
- 47.413 The State in Advanced Capitalist Societies
- 47.414 Theory and Practice in Third World Development
- 47.415 Selected Problems in Third World Development
- 47.420 Policy Making in the United States
- 47.421 Politics of Influence in the United States
- 47.422 Constitutional Politics
- 47.430 Concepts of the State
- 47.431 Marxist Thought
- 47.432 Contemporary Marxism
- 47.435 Contemporary Political Theory
- 47.446 Theories of Public Administration
- 47.447 Decision Theories and Policy Studies
- 47.448 Public Organizations: Theory and Practice
- 47.460 Analysis of International Politics
- 47.461 Soviet Foreign Policy
- 47.466 American Foreign Policy
- 47.467 International Politics of North America
- 47.470 Political Research Design and Data Analysis
- 47.482 International Politics of Africa
- 47.483 Foreign Policies of Major East Asian Powers

Students are encouraged to look at the course offerings of the Departments of Sociology and Anthropology, and Economics; the Schools of

International Affairs, Journalism, Public Administration, and Social Work; and related disciplines at Carleton.

Except where an M.A. student is permitted to take an allied field in another discipline, a graduate student will normally take no more than one course in another department, school, or institute, in fulfilment of the M.A. or Ph.D. requirements.

Graduate Courses*

The following is a complete list of all political science graduate-level courses. Students should consult the timetable (published in early June) for a list of courses which will be offered during 1985-86.

Enrolment in graduate courses requires the permission of the department, through the supervisor of graduate studies.

- Political Science 47.501F1 or W1
Canadian Provincial Government and Politics
A research seminar on selected problems.
Prerequisite: Political Science 47.200 or permission of the department.
- Political Science 47.503F1 or W1
Political Parties in Canada
A seminar on political parties and party systems in Canadian federal politics, including an examination of patterns of historical development, party organization and finance, relationships with social movements, and the impact of Canadian federalism.
- Political Science 47.504F1 or W1
Policy Making in Canada
A study of the main policy-making actors, structures, and influences at the federal level, such as the cabinet, the bureaucracy, the central and advisory agencies, parliament, parties, interest groups, élites, secrecy and the press. Some attention will also be given to the provincial level and to the process of federal-provincial bargaining.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

● Political Science 47.505T2

Comparative Government

A research seminar dealing in the fall term with theories, methods, and problems of comparison, and in the winter term with particular themes.

● Political Science 47.506F1 or W1

Problems of Canadian Government and Politics I

A research seminar on selected problems.

● Political Science 47.507F1 or W1

Problems of Canadian Government and Politics II

A research seminar on selected problems.

● Political Science 47.508F1 or W1

The Politics of Energy and the Environment

A research seminar focusing upon the substantive issues, the policy structures and processes, and current Canadian governmental response in the area of energy policy and environmental quality management.

● Political Science 47.509F1 or W1

Canadian Political Economy

A seminar on political economy as a traditional and contemporary approach to the study of Canadian politics. The theoretical bases of this approach will be discussed, as will the controversies generated in its examination of the relationship between the Canadian state and international and domestic capitalism. Specific topics will range from the staple thesis and the national policy, to the hinterland perspective on Western Canada, and to the contemporary literature on dependency, class, and state.

● Political Science 47.510T2

The Political Process in Canada

An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups, and political leadership in Canada.

● Political Science 47.511F1 or W1

Canadian Federalism

A study of the evolution and contemporary operation of the Canadian federal system, noting particularly the specific social, political, economic, and structural features which underlie its operational performance, its resilience in crisis, and its potential for adaptation.

● Political Science 47.514F1 or W1

Comparative Communist Politics: Theory and Practice

Examination and analysis of basic models of communist political systems, with emphasis on problems of systemic change and adaptation

(inclusive of Soviet, East European and Asian systems, and Cuba).

Prerequisites: Political Science 47.320 and 47.215 or 47.312, or permission of the department.

● Political Science 47.515F1 or W1

Comparative Communist Politics: Selected Aspects
Examination and analysis of selected aspects of communist political processes, such as integration, elite formation, leadership and succession, and decision making. The emphasis will change from year to year.

Prerequisite: Political Science 47.514 or permission of the department.

● Political Science 47.516F1 or W1

Selected Problems in Soviet Politics

A seminar on selected aspects of the Soviet political system, with special attention to the inter-relationship among politics, culture, and society in the USSR.

Prerequisites: Political Science 47.100, 47.320 and 47.432, or permission of the department.

● Political Science 47.517F1 or W1

Selected Problems in African Politics

A political economy approach will be taken in this seminar, stressing the relationship of dependence, underdevelopment, participation, and class formation to the decision-making process in selected countries.

● Political Science 47.518F1 or W1

State, Revolution, and Reform in East Asia

Problems of state-building, political institutions, and policy making in the sinitic world, including the People's Republic of China, Taiwan, Japan, North and South Korea, Singapore, and Vietnam.

Prerequisite: Political Science 47.312 or permission of the department.

● Political Science 47.520F1 or W1

Nationalism

A seminar on the historical and comparative study of nationalism, with emphasis on its role in the promotion of political change.

● Political Science 47.521F1 or W1

Politics in Plural Societies

A seminar on politics in multicultural societies, with emphasis on Canada and other developed democracies. Topics will include structural segmentation, consociational processes, intergroup attitudes, and institutional adjustments to pluralism.

● Political Science 47.525F1 or W1
Problems in American Government I

A research seminar on topics such as the distribution of power, decision-making processes, the impact of technology, strains in intergovernmental relations, civil-military relations, governmental news management and secrecy; executive accountability, and impediments to reform of Congress and the presidency.

● Political Science 47.526F1 or W1
Problems in American Government II

A research seminar on topics such as political violence and social change, the roles of mass media, business elite roles, political corruption, civil rights and minority politics, and the urban crisis.

● Political Science 47.530T2
Political Theory

An intensive examination of the major questions in classical, medieval, modern, and contemporary political philosophy. This political theory course is both historically comprehensive in scope and thematically oriented in depth.

● Political Science 47.531F1 or W1
Modern Political Culture and Ideology

A theoretical investigation of leading themes in modern political culture: nature and civilization, immanence and transcendence, nihilism and reason, myth and history, magic and technology, the group and the individual.

● Political Science 47.532F1 or W1
Democratic Theories

Analysis of various democratic theories, from classical to modern, including a contemporary democratic theory of labour-managed systems applicable to welfare, liberal, and socialist states.

● Political Science 47.533F1 or W1
Inquiries in Political Philosophy

A seminar dealing with topics such as critical theory, obligation and disobedience, historicism and nihilism, and the critique of modernity.

● Political Science 47.534F1 or W1
Analytical Political Theory

The role of theory in the study of politics, and the major concepts used in political analysis. The possibilities and limitations of the historical, institutional, positivist, functional, and behavioural approaches will be emphasized.

● Political Science 47.535T2

The Canadian and American Political Traditions
A seminar on the interpretation of the American, English-Canadian, and French-Canadian political traditions, with emphasis on their comparative development.

● Political Science 47.541F1 or W1
Canadian Public Administration and Policy Analysis

The theory and practice of public administration in Canada, with emphasis on the federal level, including the role of the bureaucracy in policy making.

● Political Science 47.544F1 or W1
Public Administration in Developed Western Countries

A seminar in comparative public administration, with emphasis on Commonwealth countries, the U.S., France, and West Germany.

● Political Science 47.545F1 or W1
Public Administration in Developing Countries

A seminar on the literature and characteristics of development administration; comparison by region, country, and topic.

● Political Science 47.546F1 or W1
Theories of Public Administration

A seminar on theories of bureaucracy, organization, and comparison.

● Political Science 47.547F1 or W1
Decision Theories and Policy Studies

This course will cover decision making and policy studies in a non-mathematical way from two complementary angles: basic philosophy, psychology, and theory of individual and group decision making; and overall policy analysis as pursued by Vickers, Dror, and others, with a brief look at tools of decision making.

● Political Science 47.548F1 or W1
Research Seminar in Public Administration I

The content of this seminar will vary from year to year according to faculty research interests and student demand.

● Political Science 47.549F1 or W1
Research Seminar in Public Administration II

The content of this seminar will vary from year to year according to faculty research interests and student demand.

● Political Science 47.550T2
Problems in Western European Politics

This course will deal intensively with politics in Britain, France, Germany, Italy, and selected minor European powers both democratic and authoritarian.

● Political Science 47.551S1
Selected Problems in Political Economy I

A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture,

ideology, and social relations; and the labour process.

● Political Science 47.552S1

Selected Problems in Political Economy II

A research seminar exploring a selected topic of current research having a political economy perspective, such as power and stratification; dynamics of state action; contrasting views on administration as an instrument of political economy; culture, ideology, and social relations; and the labour process.

● Political Science 47.555F1 or W1

Selected Problems of Comparative Politics I

A research seminar which will deal with a central theme of current research in comparative politics, such as: the effects of state policy and expenditure; technology and politics; political psychology; sex/gender and politics; the military and politics; Marxism and politics; religion and politics; studies in revolution; comparative parties and interest groups.

● Political Science 47.556F1 or W1

Selected Problems of Comparative Politics II

A research seminar which will deal with a central theme of current research in comparative politics, such as: the effects of state policy and expenditure; technology and politics; political psychology; sex/gender and politics; the military and politics; Marxism and politics; religion and politics; studies in revolution; comparative parties and interest groups.

● Political Science 47.560T2

Theory and Research in International Politics

An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it.

Prerequisite: Political Science 47.460 or permission of the department.

● Political Science 47.561F1 or W1

Analysis of Canadian Foreign Policy

A research seminar on contemporary Canadian external policies, with emphasis on the analysis of cases and issues, and comparisons with other national actors.

Prerequisites: Political Science 47.260 and 47.366, or permission of the department.

● Political Science 47.570F1 or W1

Basic Research Methods

A half-course for graduate students with no background in research methods. Content: basic statistics and applications.

● Political Science 47.571F1 or W1

Research Design

A seminar in research design, including data collection and data analysis. This course will teach students to construct research designs with two foci: the traditional academic investigation of theoretical problems, and the emerging field of public policy analysis and evaluation research. *Prerequisite:* Political Science 47.570 or permission of the department.

● Political Science 47.572F1 or W1

Applied Research Methods

A half-course on problems of applying research methods to substantive problems. Topics will include adjusting designs to account for changed conditions in the field; overcoming barriers to data collection; and interpreting the results of data analysis. The course will proceed by examining completed research projects in various subfields, and applying the conclusions reached to students' research plans. Intended for students planning to engage in research in the immediate future.

Prerequisite: Political Science 47.570 or permission of the department.

● Political Science 47.573F1 or W1

Advanced Research Methods

A half-course in advanced techniques of analysis. The focus of this research seminar is the use of various mathematical and statistical techniques in the construction and analysis of political theory. The seminar may include such topics as the translation of verbal theory into formal theory, the use of statistical techniques beyond regression and correlational analysis to examine political hypotheses, and index construction, including scaling and validation techniques.

Prerequisite: Political Science 47.570 or permission of the department.

● Political Science 47.581F1 or W1

Foreign Policies of African States

The foreign policy determinants and international behaviour of African states. Each year, the seminar will focus on a particular issue area.

● Political Science 47.585F1 or W1

Foreign Policy Analysis

A research seminar dealing with selected problems in the study of foreign policy formulations and outcomes.

Prerequisite: Political Science 47.460 or permission of the department.

● Political Science 47.586F1 or W1

Strategy

A research seminar on the analysis of recent Western as well as Soviet and Chinese strategic concepts, civilian-military relations, defence policy, decision making, and arms control and disarmament.

● Political Science 47.587F1 or W1

Analysis of International Organization

A research seminar on process and change in contemporary forms of international organization. *Prerequisite:* Political Science 47.360 or permission of the department.

● Political Science 47.588F1 or W1

International Political Economy

A seminar on the changing international division of labour, and its consequences for world politics. Topics include differing patterns of industrialization, colonial relations, the role of the state, and current issues in international political economy. *Prerequisite:* Work at a senior undergraduate level is required in at least two of the following: international relations, development studies, international trade, or political economy (or permission of the department). (Also offered as International Affairs 46.588)

● Political Science 47.589F1 or W1

Problems in International Politics

A workshop on significant issues in the study of international politics, with emphasis on the state of the field (and subfields) and problems in research. *Prerequisite:* Political Science 47.560 or permission of the department.

● Political Science 47.590T2

Tutorial in a Selected Field

Tutorials or reading courses on selected topics may be arranged with the permission of the department.

● Political Science 47.591F1, W1, S1

Tutorial in a Selected Field

Tutorials or reading courses on selected topics may be arranged with the permission of the department.

● Political Science 47.594F1, W1, S1

M.A. Comprehensive Tutorial

Tutorial designed as preparation for the M.A. comprehensive examination, under the direction of members of the department. The grade to be awarded will be that obtained on the comprehensive examination.

● Political Science 47.598F2, W2, S2

M.A. Research Essay

Tutorial for students who write a research essay rather than a thesis.

● Political Science 47.599F4, W4, S4

M.A. Thesis

● Political Science 47.690F3, W3, S3

Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the major field examinations, under the direction of one or more members of the department. The grade to be awarded will be that obtained on the field examination.

● Political Science 47.691F3, W3, S3

Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the department. The grade to be awarded will be that obtained on the field examinations.

● Political Science 47.692F3, W3, S3

Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the department. The grade to be awarded will be that obtained on the field examinations.

● Political Science 47.695F3, W3, S3

Ph.D. Tutorials

Ph.D. tutorials specifically designed as intensive preparation for the major field examinations, under the direction of one or more members of the department. The grade to be awarded will be that obtained on the field examination.

● Political Science 47.699F10, W10, S10

Ph.D. Thesis

Ph.D. students in political science at Carleton University may also seek supervision from the faculty of related schools and departments, particularly the School of Public Administration, the Norman Paterson School of International Affairs, the School of Journalism, and the Departments of Economics and Sociology and Anthropology.

Department of Psychology

The Department

Chairman of the Department: W.G. Webster
Departmental Supervisor of Graduate Studies:
H.B. Ferguson

The Department of Psychology offers programs of study and research on a full-time and part-time basis, leading to the degrees of Master of Arts and Doctor of Philosophy. Financial support is available, but is limited to full-time students.

There is a very close link in the Department of Psychology between graduate studies and research. Research in the department is distributed across the life sciences areas of biopsychology, animal learning, perception, and cognition, and across the social sciences areas of social and developmental psychology. Its research and graduate program in biopsychology is one of the strongest in Canada, with current research focusing on problems of the neurochemistry of stress and learning; developmental psychopharmacology; experimental models of epilepsy; neuroanatomy; brain lateralization; neural mechanisms of audition; drug dependence; and the effects in animals and humans of prenatal alcohol and drug exposure on postnatal behaviour. The department has related and unique human neuropsychological research activities dealing with alterations to visual and auditory psychophysical functions associated with neuropathological conditions; determinants, correlates, and treatment of hyperactivity in children; and the relation of behavioural, psychological, and electrophysiological variables to sleep and dreaming states. Within the social sciences realm, a unique laboratory has been developed for the study of hypnosis, approached experimentally from social psychological, perceptual, and cognitive perspectives provided, in part, by other on-going research programs in the department. In recent years, there has been a growth of activity in aspects of applied psychology, including evaluation research; corrections; education; impact of computer and telecommunications technology; behavioural medicine; and psychological assessment. This has fostered close collaborative contacts between the department and public service and applied settings in Ottawa, such as the Children's Hospital of Eastern Ontario, the Royal Ottawa Hospital, the National Research Council, Department of Communications (Canada), Ontario Ministry of Correctional Services, and the Ottawa Board of Education. Practica and internships are available in

many of these settings to students at the doctoral level.

Because of the breadth of interests in the department, there is an emphasis in graduate courses on methodological and conceptual issues that are applicable across specific research specializations. Consequently, most substantive courses, regardless of title, are relevant to most students' programs. Students typically work very closely with their advisers who, through informal tutorials and directed studies and independent research courses, provide much of the opportunity for specialized study. Applicants are strongly encouraged to write directly to faculty members for more specific details on research interests and programs currently underway.

As part of its general experimental program, the department provides the opportunity to pursue a concentration at the doctoral level in behavioural neuroscience (a collaborative endeavour with the University of Ottawa), human neuropsychology, or human information systems. Applicants should consult with the supervisor of graduate studies for information on structuring a doctoral program of studies within a concentration.

Through a quantitative methods requirement, completion of a demanding empirical thesis presented and defended orally, participation in small seminars, and a close relationship with faculty advisers and students, the M.A. program provides the opportunity for a refinement of critical, logical, and analytical skills; skills of written and oral expression; understanding of the strengths and limitations of the scientific method as a means of problem solving, demonstrated through psychology but applicable to issues in society at large; an understanding of quantification and scaling, the use of statistical methods and inference, and the use of evidence to support argument. For some students this is a satisfactory and satisfying end in itself. For others, it provides a solid preparation for the doctoral program in which original independent study and research is stressed. The department does not distinguish between an applied and an experimental program; instead, the basic orientation is experimental and theoretical, but with opportunities, where appropriate, to provide complementary experience necessary to work successfully as a psychologist in applied research/service settings.

Augmenting the well-equipped laboratories expected in an active research environment, the Department of Psychology receives excellent technical support from the Carleton University Science Workshops, where design and manufacture of

special-purpose apparatus is carried out. In addition, the workshops provide technical support for the more than 25 computer systems currently in use in laboratories throughout the department.

Graduate students have access to the Xerox Sigma 9 and Honeywell Level 66 computer systems, supported by the Computing Services division of the University. These systems support a variety of computer languages, including FORTRAN, APL, PASCAL, and BASIC, several microcomputer emulatory programs, a variety of statistical and mathematical packages, such as the BMDP and SPSS systems, and many other programs.

In fulfilling degree credit requirements, all graduate students are required to demonstrate competence in statistical and quantitative methods through successful completion of Psychology 49.545 (with a grade of B — or better) or a qualifying examination. This is ordinarily scheduled during the first part of September, just prior to the registration period, and it encompasses the material covered in Psychology 49.545. In the event of successful completion of the examination, another course is substituted for Psychology 49.545. In the case of M.A. students, the department may recommend that a grade of C or C+ in Psychology 49.545 be accepted for credit (see page 18 of the general regulations) only after successful completion of the qualifying examination. This option is limited to those who pass the examination within two successive offerings of it, and who maintain continuous registration as graduate students between the first registration in Psychology 49.545 and the taking of the examination.

In addition to fulfilling the remaining credit requirements as described in subsequent sections, all graduate students in psychology are expected to conduct research of interest to them during each year of graduate study. This requirement may be satisfied by independent research, serving as a research assistant, or by doing pilot or thesis research.

Each year, the candidate's adviser submits a written critique of research progress, and this becomes part of the candidate's permanent record. Qualifying-year students are evaluated at the end of the first 12 months. In addition to research activity, candidates may be required to serve as teaching assistants.

Depending on his/her field of concentration, a candidate may be required to demonstrate an ability to read with understanding relevant technical material in a foreign language and/or to give satisfactory evidence of competence in such areas as computer

techniques, electronic instrumentation, psychometrics, sampling procedures, or surgical techniques.

The department may recommend that a graduate student be asked to withdraw from the program at any time if his or her progress in course work, research, or comprehensive examinations proves unsatisfactory.

Qualifying-Year Program

Occasionally, candidates with exceptional promise who offer less than honours B.A. status may be admitted to a qualifying-year program, approved by the graduate studies committee, and designed to prepare them for master's study. A minimum grade of B — must be obtained in each qualifying-year course, and candidates may be required to complete satisfactorily the equivalent of an honours B.A. thesis.

Master of Arts

Admission Requirements

The normal requirement for admission into the master's program is an Ontario honours B.A. (or its equivalent) with high second-class standing and with credit in the following areas: statistics and design of experiments; experimental psychology; learning or motivation; physiology and/or comparative psychology; and history and/or systems.

Candidates with particular course deficiencies may be required to register in additional courses at Carleton.

Scores on the Graduate Record Examination are required at the time of application.

The deadline for submitting applications for graduate study in psychology are as follows: February 1 for students requesting financial assistance; July 1 for students not requesting financial assistance but who are seeking admission in September; and November 1 for students who are seeking admission in January.

Program Requirements

The master's program usually consists of three full courses (or the equivalent), of which at least two must be at the graduate level (numbered 500 or higher), and a thesis (equivalent to two full courses) which must be defended at an oral examination. Psychology 49.545, or the successful completion of the opt-out examination in quantitative methods, is required

of all graduate students. Course credit will not be given for successful completion of the opting-out examination.

Academic Standing

A grade of B- or better is normally required in each of the courses counted for credit towards the M.A. degree. The department is prepared on occasion to recommend to the dean that a candidate be allowed a grade of C+ or C (but not C-) in one full course or each of two half-courses. In the case of Psychology 49.545, such a recommendation will be based on successful completion of the qualifying examination. This option is limited to those who pass the examination within two successive offerings of it, and who maintain continuous registration as graduate students between the first registration in Psychology 49.545 and the taking of the examination.

Doctor of Philosophy

Admission Requirements

The requirements for admission to Ph.D. programs are outlined in the general section of this calendar. Scores on the Graduate Record Examination are also required at the time of application.

The Ph.D. program in psychology normally will be undertaken on a full-time basis; however, in cases of exceptional merit, the department will accept a few candidates for the degree on a part-time basis. A Ph.D. candidate who enters the part-time program will normally be required to be registered as a full-time student for a minimum of three terms, at least two of which are consecutive. The time limit for completion of Ph.D. degree requirements for those who enter the program on a part-time basis will be the same as for those who enter on a full-time basis and subsequently register for part-time study: that is, eight calendar years. (See Time Limits, page 20)

Applicants should note that of the B.A., M.A., and Ph.D. degrees in Psychology, only two may ordinarily be taken at Carleton University.

Program Requirements

The minimum program requirements for the Ph.D. degree in Psychology are as follows:

- 10 full-course credits, with a minimum grade of B – in each course
- Psychology 49.545, its equivalent, or the successful completion of the opting-out examination in quantitative methods, is required of all graduate students. In the latter instance, another course is substituted for 49.545

- A thesis equivalent to four of the required 10 full-course credits will be required for concentration in the history of psychology. Ordinarily, in the other areas of psychology, the thesis will be offered in fulfilment of five of the required 10 credits.

Comprehensive Examinations

All Ph.D. candidates are required to pass written and oral examinations in their area of specialization. There are two optional forms for the written comprehensive examination: two major essays, or one major essay and one research grant proposal. The submission of each essay or grant proposal will be followed within one to three weeks by a comprehensive oral examination, which is not restricted to issues raised by the written portion.

Ordinarily, the comprehensive examinations must be completed successfully before the Ph.D. prospectus meeting is scheduled. One oral defence must occur within four calendar terms of the student's initial registration in the Ph.D. program; the second must be defended within six calendar terms of initial registration.

Graduate Courses*

- Psychology 49.510F1
Research Methods in Social Psychology I
Experience with research and data analysis techniques of particular relevance for social psychology, such as sampling, attitude scaling, and measurement. Normally required of students writing a thesis in social psychology.
- Psychology 49.511W1
Research Methods in Social Psychology II
Current ethical and methodological issues in social psychological research, such as experimental effects, deception, and subject variables. Normally required of students writing a thesis in social psychology.
- Psychology 49.515F1
Fundamentals of Computing for Psychologists
A survey of computer and communication hardware and software. The purpose of the course is to make

*F,W,S indicates term of offering.
Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

psychologists aware of the concepts and terminology used by engineers and programmers in planning computer applications; it is not designed to train students to be programmers or to build equipment. The course will have a weekly laboratory.

Prerequisite: One course in computer programming.

● Psychology 49.516

Applications of Computers to Thinking, Problem Solving, and Decision Making

A survey of literature in such fields as artificial intelligence, database management, computer-aided instruction, simulation and forecasting, and computer-mediated communication. Psychological principles in the design, use, and evaluation of these cognitive aids will be stressed.

Prerequisite: Psychology 49.515.

● Psychology 49.520T2

Neuroscience

An evaluation of current methodologies, concepts and knowledge in brain science. The emphasis will be upon behavioural neuroscience and neuropsychology. Lectures to be presented by neuroscientists from Carleton University and the University of Ottawa.

● Psychology 49.530W1

Perceptual Processes

Theoretical and empirical issues and implications of the area of perception, with attention to psychophysics, information processing, physiological mechanisms, and the ontogeny of perception.

● Psychology 49.545T2

Quantitative Psychology

The application of selected statistical techniques in psychology, including basic hypothesis testing, analysis of variance, multiple linear regression, nonparametric techniques, and multivariate analyses. Extensive use is made of computer statistical packages.

● Psychology 49.546F1

Advanced Methodology

An in-depth exposure to various methodological and statistical problems related to students' chosen areas of specialization; to examine in detail and gain experience with various statistical programs, such as SPSS.

Prerequisite: Computing Science 95.101.

● Psychology 49.547F1

Tests and Measurements

The administration and use of representative psychological tests.

Prerequisite: Psychology 49.330 or its graduate equivalent when offered.

● Psychology 49.551F1

Developmental Psychology I

A detailed examination of selected issues in developmental psychology.

● Psychology 49.552W1

Developmental Psychology II

A continuation of 49.551.

● Psychology 49.561W1

Contemporary Research in Personality

Current controversial issues in personality research, and selected theoretical and research studies in personality.

● Psychology 49.570F1

Research Methods in Learning

Methods, research design, and instrumentation in the fields of learning and retention, with emphasis on response definition and measurement, procedures for monitoring the learning process, and problems of control.

● Psychology 49.573W1

Human Learning

A discussion of selected topics within the area of human learning.

● Psychology 49.575F1

Behaviour Modification I

The basic principles of learning as they apply to the modification of behaviour, with emphasis on application, ethics, research, and methodology.

● Psychology 49.576W1

Behaviour Modification II

Special problems, topics, and projects related to behaviour modification.

Prerequisite: Psychology 49.575.

● Psychology 49.580F1, W1, S1

Special Topics in Psychology

The topics of this course will vary from year to year, and will be announced in advance of the registration period.

● Psychology 49.590F1, W1, S1

Directed Studies

An investigation in depth of selected problems in psychology by means of directed library research. Registration is restricted, permission to register being granted only by the graduate committee. A final report must be filed in the departmental office prior to submission of course grade.

● Psychology 49.591F1, W1, S1

Independent Research

Permission to register and approval of research plan must be obtained from the graduate committee. A final research report must be filed in the departmental office prior to submission of course grade. The course may be repeated for credit.

- Psychology 49.599F4, W4, S4
M.A. Thesis

- Psychology 49.600F1

Systems of Psychology

Historical research methods on the study of psychological movements and problems of the late nineteenth and early twentieth centuries; may be repeated for credit.

(Open with permission to advanced undergraduates)

- Psychology 49.601W1

Problems in the History of Psychology

A study of one or more selected topics in the history of man's attempt to understand his own nature; may be repeated for credit.

(Open with permission to advanced undergraduates)

- Psychology 49.603

Observation, Description, and Explanation in Psychology

Problems of communication, concept formation, and exploration in the biosocial sciences are discussed. The interplay of facts, methods, models, theories, and the human values which these serve are also explored.

- Psychology 49.610F1

Research Seminar in Social Psychology I

- Psychology 49.611W1

Research Seminar in Social Psychology II

- Psychology 49.612F1

Experimental Hypnosis

Selected issues in the study of experimental hypnosis will be critically reviewed. The problem of hypnotic susceptibility and its correlates will be given particular attention. Relationships among hypnotic phenomena, meditation, and behaviour therapy will be evaluated.

- Psychology 49.615

Psychological Aspects of Computer Use

An investigation of human factors related to the effective design of computer hardware and software. Topics may include the design and evaluation of information search procedures, graphic displays, and operation manuals on the assessment of useability. A research project will be required.

- Psychology 49.616

Social Aspects of Computer Use

An investigation of the social psychological and political factors affecting the adoption and use of computers. Topics may include the design and evaluation of training programs, the assessment of attitudes towards computers, threats to privacy and

jobs, and computer crime. Emphasis will be placed upon the organizational and interpersonal changes resulting from the introduction of computers into work settings. A research project will be required.

- Psychology 49.620F1

Research Seminar in Physiological Psychology I

- Psychology 49.621W1

Research Seminar in Physiological Psychology II

- Psychology 49.626F1

Comparative Psychology

Varied and acquired adaptive mechanisms and their phylogenesis. Topics will include attachment behaviour, social organization, learning abilities, communication, and motivation.

- Psychology 49.650F1

Research Seminar in Developmental Psychology I

- Psychology 49.651W1

Research Seminar in Developmental Psychology II

- Psychology 49.661F1

Seminar in Human Neuropsychology I

A broad and intensive consideration of selected topics in human neuropsychology, integrating findings from psychology with related medical literature.

- Psychology 49.662W1

Neuropsychological Assessment

Review of the rationale and practice of diagnosis and treatment based on neuropsychological test results. The reliability and validity of test batteries such as the Halstead-Reitan and the Luria-Nebraska are studied. A variety of methods of test interpretation are utilized in clinical analysis of patient protocols, including degenerative diseases, psychiatric disorders, seizures, head injury, and brain tumors.

Prerequisite: Psychology 49.661.

- Psychology 49.663F1

Seminar in Human Neuropsychology III

(Same description as 49.661)

- Psychology 49.664W1

Theories of Brain Dysfunction in Psychopathology

A review of neuropsychological theoretical explanations and empirical findings regarding brain functioning in a variety of organic and psychiatric disorders, such as autism, schizophrenia, minimal brain dysfunction, anorexia nervosa, aphasia, and memory disorders. These disorders are examined from neurological, psychological, biochemical, and neuropsychological points of view.

Prerequisite: Psychology 49.661.

- Psychology 49.665F1

Comparative Neuropsychology

An examination, from a comparative perspective, of research and logic associated with the study of brain-behaviour relations. The objective of the course is to provide a background and orientation for evaluating infra-human research of brain-behaviour relations, and for relating such research to problems of human neuropsychology.

- Psychology 49.666W1

Human Communication Disorders

The course provides an overview of normal and abnormal functions of the auditory system, particularly as it relates to the perception of human speech sounds. Diagnosis of clinical syndromes will be covered.

- Psychology 49.667W1

Developmental Psychopharmacology

The synthesis and metabolism of various neurotransmitters are detailed with respect to their role in behaviour modulation. The ontogeny of these systems is considered, as are behavioural changes which occur as a consequence of aberrant neurochemical activity.

(Open with permission to advanced undergraduates)

- Psychology 49.670F1, W1

Research Seminar in Learning

- Psychology 49.680F1, W1

Special Topics in Psychology

(Same description as 49.580)

- Psychology 49.690F1, W1, S1

Directed Studies

(Same description as 49.590)

- Psychology 49.691F1, W1, S1

Independent Research

(Same description as 49.591)

- Psychology 49.693

Practicum in Psychology

The practicum offers graduate students experience in a range of applied psychology settings (for example, hospitals, schools, and correctional centres). Students participate in training sessions and work experience, facilitating the integration of academic and practical aspects of psychology. Details of current practicum placements are available from the department. This course cannot be repeated for credit. Students will receive a grade of satisfactory or unsatisfactory.

- Psychology 49.699F, W, S

Ph.D. Thesis

Through inter-university co-operation in graduate instruction, full-time graduate students registered in the Department of Psychology may enrol in one course at the University of Ottawa.

The Ottawa-Carleton Specialization in Neuroscience

The Specialization

Coordinator of the Specialization: B.A. Pappas

Neuroscience is the study of the nervous system and its function. This emerging field cuts across many disciplines and incorporates such areas as anatomy, neurobiology, pharmacology, physiology and psychology. While individual researchers usually specialize in a particular area, neuroscientists today must also be able to appreciate significant research in the other fields and therefore require an understanding of the basics of the other disciplines.

Training in the neurosciences extends past the boundaries of traditional departments. In response to the challenge of providing a comprehensive education for future neuroscientists, the University of Ottawa and Carleton University now offer a multi-disciplinary specialization in neuroscience.

The specialization is intended to augment the research and training which the student receives through one of the "primary" departments which are participating in the neuroscience specialization. The departments are:

- Department of Anatomy, University of Ottawa
- Department of Biology, Carleton University
- Department of Biology, University of Ottawa
- Department of Pharmacology, University of Ottawa
- Department of Physiology, University of Ottawa
- Department of Psychology, Carleton University
- School of Psychology, University of Ottawa

Three additional departments from the University of Ottawa Medical School are also affiliated, and add a clinical perspective to the specialization:

- Department of Medicine (Division of Neurology)
- Department of Psychiatry
- Department of Surgery (Division of Neurosurgery)

The specialization is coordinated by a committee consisting of representatives from each of the participating departments.

Application should be made to the primary department which is most appropriate to the student's research interest. Once accepted by the department, students must be sponsored into the specialization by a member of the neuroscience faculty.

Application forms and further information can be obtained by writing directly to any of the "primary" departments.

Members of the Neuroscience Specialization

Hymie Anisman, *Stress; Neurochemical Liability; Depression*

R.J. Broughton, *Sleep; Biological Rhythms; Clinical Neuropsychology; Psychophysiology*

J.M. DeKoninck, *Sleep; Dreams; Personality*

J. de la Torre, *Brain and Spinal Cord Trauma; Catecholamines*

Brock Fenton, *Acoustic Behavior of Bats and their Insect Preys*

H.B. Ferguson, *Biochemical and Neurological Models of Behavioural Learning Disorders in Children*

Georges Fouriez, *Neurobiology of Brain Stimulation Reward*

P.A. Fried, *Pre-natal Exposure to Marihuana, Alcohol, and Nicotine; Behavioural Teratology*

J.N. Fryer, *Neuroendocrinology; Neuropeptides; Pituitary; Peptide receptors; Neurosecretion*

D.R. Gardner, *Action of Pesticides on Invertebrate Excitable Tissue*

W.J. Hendelman, *Tissue Culture; Synaptogenesis; Development; Catecholamines; Receptors*

P.D. Hrdina, *Neuropharmacology of Anti-depressants; Receptor Binding*

L.P. Ivan, *Head Injury, Intracranial Pressure Monitoring*

J.B. Kelly, *Central Auditory Function; Development of Hearing; Comparative Psychophysics*

R.M. Knights, *Head Injuries; Clinical Neuropsychology*

John Kucharczyk, *Neural Control of Sexual and Ingestive Behaviours; Intracranial Self-stimulation; Peptides; Thermoregulation*

Leonard Maler, *Ion Channels and Neurotransmitters; Descending Control of Sensory Systems*

K.C. Marshall, *Synaptic Transmission; Catecholamines; Tissue Culture; Locus Coeruleus; Neuromodulation; Neuronal Electrophysiology*

I.M. Mazurkiewicz-Kwilecki, *Brain Histamine; Neuropharmacology of Stress and Aging*

D.C. McIntyre, *Kindled Epilepsy; Catecholamines; Limbic System Electrophysiology; Aggression; Memory Mechanisms*

Zulfikar Merali, *Behavioural and Biochemical Toxicology of Lead and Cadmium; Behavioural Pharmacology of Peptides*

Janis Metuzals, *Immuno-electron Microscopy; Neurofilaments; Alzheimer's Disease; Squid Axons*

Thérís Miliaressis, *Neural Basis of Motivation; Neurotransmitters and Behaviour; Behavioural Neurophysiology*

Catherine Morris, *Electrophysiology of Ion Channels in Brain and Muscle; Tissue Culture*

B.A. Pappas, *Developmental Psychopharmacology; Steroid Effects on Brain; Locus Coeruleus*

D.J. Parry, *Nerve-muscle Trophic Interactions; Muscular Dystrophy; Immunohistochemistry; Post-tetanic Potentiation; Motor Units*

D.A.V. Peters, *Neuropharmacology of Brain Development and Stress; Catecholamines*

T.W. Picton, *Human Neurophysiology; Cognition; Evoked Potentials; Audition*

R.T. Pivik, *Sleep; Neurophysiology; Psychophysiology and Biological Psychiatry*

D.C.S. Roberts, *Neuropharmacology; Drugs of Abuse; Reinforcement; Steroid Effects on Brain*

D.T. Stuss, *Neuropsychology; Evoked Potentials; Frontal Lobes*

Janos Szabo, *Brain Pathways; Autoradiography; Horseradish Peroxidase; Immunohistochemistry*

B.W. Tansley, *Spectral Difference Processing in Vision and Hearing; Diagnostic Neurophysiology of Sensory Systems*

T.N. Tombaugh, *Behavioural Psychopharmacology; Neuroleptics; Drug Abuse*

R.L. Trites, *Hyperactivity in Children; Clinical Neuropsychology*

W.G. Webster, *Neuropsychology; Brain Lateralization; Diet and Nutrition; Stuttering; Motor Skills*

R.M. Zacharko, *Brain Stimulation Reward; Depression; Stress*

Master of Science

Admission Requirements

Admission to the M.Sc. specialization is primarily intended for medical residents who wish to add a Neuroscience research and study component to their program. The requirements for admission to the M.Sc. specialization are as follows:

- Prior admission to the M.Sc. program of the primary department which participates in the specialization.
- A letter of recommendation from a participating faculty member of the neuroscience specialization, which both recommends admission and which indicates the willingness of the faculty member to supervise the candidate's research program.
- Two additional letters of recommendation from University faculty who are familiar with the candidate's academic and/or research career.

Students with less than a high second-class average in their undergraduate and graduate courses will not normally be recommended for admission.

Program Requirements

In addition to fulfilling the requirements for the master's program in the department in which they are enrolled, the specialization requires that students successfully complete one of the core neuroscience courses (see Ph.D. requirements) and that the thesis research be in a neuroscience related topic.

Doctor of Philosophy

Admission Requirements

Admission requirements to the Ph.D. neuroscience specialization are as follows:

- Prior admission to the Ph.D. program of the primary department which participates in the specialization.
- A letter of recommendation from a participating faculty member of the neuroscience specialization, which both recommends admission and which indicates the willingness of the faculty member to supervise the candidate's research program.
- Two additional letters of recommendation from University faculty who are familiar with the candidate's academic and research career.

Students with less than a high second-class standing in their undergraduate and graduate courses will not normally be recommended for admission.

Selection of master's and doctoral students is carried out by the Neuroscience Specialization Coordinating Committee which will select and rank the admissible candidates. Admission is determined by priority of ranking and the number of admittees depends upon the available positions in the specialization.

Program Requirements

Students must fulfill the Ph.D. program requirements of the department in which they are enrolled. The requirements for the specialization also include the following, some of which may satisfy the Ph.D. requirements of the participating departments:

- Successful completion of the three core courses: Neuroanatomy and Neurophysiology, Behavioural Neuroscience, and Neuroscience Techniques.
- Successful completion of a comprehensive examination in neuroscience. In many cases, this may satisfy one of the comprehensive requirements of the department in which the student is enrolled.

- A thesis in the area of neuroscience, which must be defended at an oral examination.

Graduate Courses*

A variety of neuroscience courses are available through the primary departments. These currently include neuroendocrinology, clinical neuro-psychology, synaptic transmission and behavioural medicine. Course offerings vary slightly from year to year and a complete listing can be obtained from the specialization Coordinator.

The following are the three core courses of the curriculum.

- Psychology 49.520T2 (PSY7990)

Behavioural Neuroscience

An evaluation of current methodologies, concepts and knowledge in brain science. The emphasis will be upon behavioural neuroscience and neuropsychology.

- Psychology 49.622T2 (ANA7400)

Neuroscience Techniques

A series of laboratory sessions will provide the rationale and applications for various research techniques in neuroscience.

(Also offered in Biology as 61.633).

- Psychology 49.623T2 (ANA5470)

Neuroanatomy and Neurophysiology

An integrated course on the central nervous system given by the departments of Anatomy and Physiology of the University of Ottawa and their invited lecturers.

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

The School

Director of the School: A.M. Maslove

Associate Director: Eugene Swimmer

Co-ordinator, Specialization in Development Administration: N.H. Lithwick.

The School of Public Administration was established in 1953 through the assistance of a generous grant from the Atkinson Charitable Foundation.

The school offers two graduate programs of study and research in the field of administration. Prospective applicants are urged to evaluate these two opportunities carefully in order that they may select the one most suitable to their interests, background, and academic qualifications.

Students are encouraged to acquire French language skills. Undergraduate French language courses may be taken as extra to degree, and many other options are available in the National Capital Region. Students may consult the school.

Diploma in Public Administration (D.P.A.)

This diploma program, which consists of five full courses or the equivalent, is more fully described below. It is designed to offer those persons in (or planning to enter) administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies.

Master of Arts

The M.A. program is designed to provide a balanced exposure to both administrative studies and public policy. It is more fully described on the following pages.

Two main areas of specialization are offered:

- 1) Canadian public administration and policy and
- 2) development administration. The development administration specialization is offered with the co-operation of the Norman Paterson School of International Affairs. Only students who intend to complete the M.A. program are admitted to the development administration specialization. However, these students are eligible to receive the D.P.A. upon completion of the required courses. The requirements of the development administration specialization are described in the section dealing with the Master of Arts.

Inquiries and requests for further information should be directed to the school.

Graduate Diploma in Public Administration

The Diploma in Public Administration is designed to offer those persons in (or planning to enter) administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies. The program consists of five courses and may be taken on a part-time, full-time, or mixed part-time and full-time basis.

The program is based on the recognition that persons with widely varying backgrounds will enter it. Students who successfully complete the D.P.A. program may apply for admission to the M.A. program, at which time they will be considered for admission along with all other applicants. If all of the first-year courses are not taken as part of the D.P.A., they will be required in addition to the final M.A. courses.

Admission Requirements

Admission to the graduate program in public administration is selective. To be considered for admission, an applicant must have a bachelor's degree with at least high second-class standing from a recognized university, and must have completed courses in introductory economics (Economics 43.100 or the equivalent) and Canadian government and politics (Political Science 47.200 or the equivalent). If an applicant has not completed the economics and political science prerequisites, they must be completed in addition to the student's program, with a grade of C or better. All students who have completed the prerequisites (particularly if completed several years ago) will be expected to have a working knowledge of the material in these courses.

Applicants are advised to submit applications before July 1 as enrolment in the school is limited.

Program Requirements

The program consists of five full-course credits, at least four of which must be completed at Carleton. Advanced standing may be granted in one full course (or equivalent) if previous work is judged to be equivalent to courses required in the program. A student who has taken one (or more) of the other required courses prior to admission must substitute another course (or courses) in consultation with the supervisor of graduate studies. In the event that a

part-time student is required by his/her employer to move away from Ottawa, he/she may apply to complete one full course or the equivalent at another university, provided that no transfer of credit was granted on admission.

Students are required to complete any five full courses from the following program:

- Admin. 50.500: Public-Sector Managing and the Canadian Political System
- Admin. 50.510: Management Accounting and Administration
- Admin. 50.511: Financial Management
- Admin. 50.522: Macroeconomics for Management and Policy
- Admin. 50.523: Microeconomics for Management and Policy
- Admin. 50.530: Organizational Behaviour I
- Admin. 50.536: Law of Public Authorities I
- Admin. 50.551: Quantitative Methods I
- Admin. 50.552: Quantitative Methods II
- Admin. 50.567: Public Sector–Private Sector Relations
- Admin. 50.568: Policy and Decision Making

Part-time students already admitted to the D.P.A. program under the provisions of previous calendars may adjust their programs to take advantage of the revised program outlined above.

Academic Standing

All candidates are required to obtain a grade of B – or better in each course in the program. A candidate may, with the recommendation of the school and the approval of the Faculty of Graduate Studies and Research, be allowed a grade of C + in one half-course.

Master of Arts

The master's program is specifically designed to provide the prospective and the mid-career administrator with a balanced exposure to administrative studies and to public policy.

The contemporary manager or administrator is increasingly required to be both a policy adviser and formulator and to have a substantive understanding of the many disciplines and variables associated with the decision-making process in contemporary organizations. University programs can begin to provide some of the foundations that will enable persons to acquire an understanding of the broad financial, legal, economic, political, and social interrelationships that affect decisions in any organization.

The Canadian public administration and policy specialization in the M.A. program is designed to

prepare students for managerial, policy, and managerial-support roles in the public services of Canada (federal, provincial, regional, and municipal), and to accelerate and enrich the education and the development of those already performing such roles. Because it is conducted in conjunction with, and draws upon, a program of advanced research in administrative studies and public policy, it is also designed to meet the educational needs of those who wish to undertake graduate-level work in public policy and management, but who may not have a current commitment to public service careers.

A limited number of internships are arranged for full-time second-year students. An internship is the placement of a senior student in a government or other organization to work at a junior officer level. It facilitates the integration of the academic and practical aspects of public administration. It is offered to selected full-time second-year students and is dependent on eligibility and the number of suitable placements that can be developed. See the calendar description under 50.595T.

The specialization in development administration, offered in conjunction with the Norman Paterson School of International Affairs, is designed to address the unique nature and problems of developing countries. It is intended to provide students from developing countries and others with an interest in this field with the knowledge and skills necessary to function successfully in the particular environments of these countries.

Degree Schedules

The degree can be taken in one of three basic modes: full-time, part-time, or through a mixed part-time and full-time schedule:

● The Full-Time Schedule

A full-time student can complete the program in two years (four academic terms), but typically may require a fifth (usually summer) term to complete the requirements, depending upon the amount of advanced standing granted for previous courses.

● The Part-Time Schedule

A part-time student normally completes from two to four half-courses during the regular academic year, typically in evening courses. Certain courses are also available during the summer term. The duration of a part-time program normally varies from five to eight years.

● Mixed Part-Time and Full-Time Schedule

This schedule enables the student to alternate periods of full-time and part-time study. Typically, students will begin on a part-time basis, but may study on a full-time basis for at least one semester. Such full-time study, which may commence in either the fall, winter, or spring term, is especially

suitable for practising mid-career administrators as it facilitates a flexible sequence for study and normal work periods.

Admission Requirements

To be considered for admission, an applicant must have a bachelor's degree (or equivalent) with at least high second-class standing from a recognized university, and must already have completed courses in introductory economics (Economics 43.100 or equivalent) and Canadian government (Political Science 47.200 or equivalent).

If an applicant has not completed the economics and political science prerequisites, they must be completed in addition to the student's graduate program, with a grade of C or better. All students who have completed the prerequisites (particularly if completed several years ago) will be expected to have a working knowledge of the material in these courses.

Applicants to the development administration stream will not be required to complete the Canadian government prerequisite. These applicants must, however, satisfy the economics prerequisite. In addition, they are advised that they must have a capacity to study and communicate in English and must have a working knowledge of mathematics at least at the high school matriculation level. Students deficient in any of these areas may be required to rectify these deficiencies during the summer session prior to the commencement of the regular program.

Applicants are advised to submit applications before July 1 as enrolment in the school is limited.

The school also gives special consideration to mid-career applicants. To qualify for mid-career admission, applicants must have spent several years in one of the public services, or be performing managerial or related functions in a private-sector organization and have demonstrated excellence in their performance in these organizations.

The school's admission policy will, of course, be governed by the availability of graduate student space and the need to admit applicants from a variety of disciplines and backgrounds (for example, social sciences, humanities, law, engineering, or science). Possession of the minimum admission requirements does not, in itself, guarantee acceptance.

Advanced standing may be granted for required courses only if previous work is judged to be equivalent to courses required in the program. Advanced standing and transfer of credit must be determined on an individual basis in consultation with the director, and must also be approved at the time of admission by the dean of the Faculty of Graduate Studies and Research. In general, a grade

of B — or better is required in equivalent courses to obtain advanced standing.

Program Requirements

The M.A. program comprises 20 half-courses (or the equivalent).

Students generally begin their program with required courses; it is possible, however, to take a mixture of optional and required courses throughout both years, provided that the student has the necessary prerequisites for any specific options selected.

Canadian Public Administration and Policy Specialization

Required Courses

- Admin. 50.500: Public-Sector Managing and the Canadian Political System
- Admin. 50.510: Management Accounting
- Admin. 50.511: Financial Management
- Admin. 50.522: Macroeconomics for Management and Policy
- Admin. 50.523: Microeconomics for Management and Policy
- Admin. 50.530: Organizational Behaviour I
- Admin. 50.536: Law of Public Authorities I
- Admin. 50.551: Quantitative Methods I
- Admin. 50.552: Quantitative Methods II
- Admin. 50.567: Public Sector — Private Sector Relations
- Admin. 50.568: Policy and Decision Making

Students who have successfully completed the requirements for the Diploma in Public Administration and who are unable to continue their M.A. program may be awarded the diploma, provided that four full courses have been taken at Carleton University.

Optional Courses

- One half-course selected from Stream 1 listed below, and
- Two half-courses selected from Stream 2 listed below, and
- Six half-courses selected from any of the streams listed below, or
- A thesis (equivalent to four half-courses) and two half-course options, or
- A research essay (equivalent to two half-courses) and four half-course options

Development Administration Specialization

Required Courses

- Admin. 50.510: Management Accounting
- Admin. 50.511: Financial Management*
- Admin. 50.523: Microeconomics for Management and Policy*
- Admin. 50.530: Organizational Behaviour I*

- Admin. 50.551: Quantitative Methods I
- Admin. 50.552: Quantitative Methods II
- Admin. 50.568: Policy and Decision Making*
- International Affairs 46.507: Theories of Development and Underdevelopment
- International Affairs 46.508: Development Planning: Theory and Practice
- International Affairs 46.537: Macroeconomics in a Development Context

Students who are unable to continue in their M.A. program may be awarded the Diploma in Public Administration provided that they successfully complete the diploma requirements and that four full-courses have been taken at Carleton University.

Optional Courses

In consultation with the Co-ordinator of the Development Administration specialization, students must select:

- Ten half-courses from Stream 3 listed below, or
- A special project in development administration (50.597, equivalent to two half-courses) and eight other half-course options from Stream 3.

Stream 1 — Public Policy Analysis

Administration

- 50.501 Policy and Administration in Intergovernmental Relations
- 50.502 The Political Economy of Regulation
- 50.513 Budget Decision Making and Budgeting
- 50.565 Government-Industry Policy Relations
- 50.566 Science and Technology Policies
- 50.569 Advanced Policy and Decision Analysis
- 50.570,571,572,573 Policy Seminars
- 50.574 Urban Policy Analysis
- 50.575 Advanced Statistical Policy Analysis

Stream 2 — Public Management

Administration

- 50.514 Public-Sector Accounting and Finance
- 50.515 Management in the Public Service
- 50.516 Urban and Local Government Management
- 50.517 Public Management in Developing Countries
- 50.518 Marketing for Non-Profit Organizations
- 50.519 Management of Public Enterprise
- 50.520 Public-Sector Investment and Pricing
- 50.528 Management Information Systems I
- 50.529 Management Information Systems II
- 50.531 Organizational Behaviour II
- 50.537 Law of Public Authorities II

- 50.538 The Management of Provincial Government
- 50.562 Planning and Evaluation in Government I
- 50.563 Program Assessment Design
- 50.581 Staffing and Personnel Management
- 50.583 Problems in Organizational Change and Development
- 50.584 Industrial Relations and Public-Sector Collective Bargaining
- 50.585 Public-Sector Collective Bargaining

Stream 3 — Development Administration

- 50.502 The Political Economy of Regulation
- 50.514 Public-Sector Accounting and Finance
- 50.519 Management of Public Enterprise
- 50.520 Public Sector Investment and Pricing
- 50.528 Management Information Systems I
- 50.529 Management Information Systems II
- 50.536 Law of Public Authorities I
- 50.562 Planning and Evaluation in Government
- 50.563 Program Assessment Design
- 50.565 Government-Industry Policy Relations
- 50.572 Regional Policy
- 50.574 Urban Policy
- 50.597 Special Project in Development Administration (1 credit)

International Affairs

- 46.506 Agriculture and Rural Development
- 46.512 Canada and International Development
- 46.538 International Economics: Policy and Theory
- 46.539 International Financial and Monetary Institutions and Policy
- 46.540 International Development and International Organizations
- 46.561 Historical Dimensions of Development and Underdevelopment
- 46.562 Ethical and Cultural Dimensions in Development Studies
- 46.563 Problems of Development in Africa
- 46.564 Problems of Development in Latin America
- 46.567 Development in South East Asia
- 46.569 Social Cost-Benefit Analysis and Development Project Evaluation
- 46.581 Regional Co-operation Among Developing Countries

Economics

- 43.533 Regulation and Public Enterprise
- 43.543 Public Choice
- 43.547 Project Evaluation
- 43.554 Economic Development: Internal Aspects
- 43.562 International Monetary Theory and Policy

Political Science

- 47.545 Public Administration in Developing Countries

School of Business

To be determined.

*Special sections of these courses will be offered for students in the Development Administration specialization.

Stream 4 — Recommended Options Offered by other Carleton Departments and Schools and by the University of Ottawa

(This is not a complete list of all the acceptable options. Students should contact the supervisor of graduate studies or the director for approval if there are other courses they wish to take which are not on this list.)

Economics

- 43.505 Econometrics
- 43.511 Canadian Economy I
- 43.532 Competition Policy
- 43.533 Regulation and Public Enterprise
- 43.541 Public Economics: Expenditure
- 43.542 Public Economics: Taxation
- 43.547 Project Evaluation
- 43.555 Economic Development: International Aspects
- 43.581 Regional Economics
- 43.582 Urban Economics

International Affairs

- 46.510 Development of Canada's International Relations
- 46.511 Canada in the International Political Economy
- 46.512 Canada and International Development
- 46.513 Canada and International Conflict
- 46.530 International Enterprise: Analytical Approaches
- 46.531 International Enterprise
- 46.532 Science, Technology, and International Affairs: The Advanced, Industrial Countries
- 46.533 Science, Technology, and International Affairs: The Third World

Journalism

- 28.434 Media and Society I
- 28.435 Media and Society II
- 28.462 Public Issues in Canada
- 28.532 Press and Government

Law

- 51.440 The Arbitration Process in Industrial Relations
- 51.445 Labour Relations in the Public Service
- 51.450 Canadian Constitutional Law
- 51.556 Advanced Administrative Law Problems

Political Science

- 47.501 Canadian Provincial Government and Politics
- 47.508 The Politics of Energy and the Environment
- 47.544 Public Administration in Developed Western Countries

- 47.545 Public Administration in Developing Countries
- 47.547 Decision Theories and Policy Studies
- 47.561 Analysis of Canadian Foreign Policy

Social Work

- 52.511 Social Policy Analysis
- 52.514 Housing Policy
- 52.515 Poverty and Wealth
- 52.540 Social Administration and Policy
- 52.541 Management of Social Programs
- 52.551 Program Evaluation

Sociology and Anthropology

- 53.506 Economy and Society
- 53.525 Canadian Society
- 53.527 Sociology of Formal Organizations
- 53.529 Sociology of Science and Technology
- 53.530 Social Institutions I: Women and the Canadian Economy: Research and Policy Issues
- 53.532 The Labour Process
- 53.540 Political Sociology

University of Ottawa

- ADM5320 Marketing
- ADM5380 Management Decision Models
- ADM6320 Marketing Research
- ADM6340 Accounting for Managerial Planning and Control
- ADM6352 Empirical Methods in Financial Economics
- ADM6380 The Modelling of Management Decisions Under Uncertainty

Academic Standing

All candidates are required to obtain a grade of B — or better in each course in the program. A candidate may, with the recommendation of the school and the approval of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one half-course.

Required Courses*

- Administration 50.500F1
Public-Sector Managing and the Canadian Political System
An examination of the central features and influences of the Canadian political systems on public service managerial and policy roles. An examina-

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

tion of the application of managerial concepts and approaches in Canadian public administration.

Prerequisite: Political Science 47.200.

V.S. Wilson, Michael Prince, and D.G. Swartz.

● Administration 50.510F1, W1

Management Accounting

An introduction to the underlying assumptions and basic principles of accounting, and an examination of the uses of accounting information by management. Topics include income measurement, asset valuation, financial statement analysis, cost systems, control reports, operating budgets, capital expenditure decisions, and alternative choice problems.

● Administration 50.511F1, W1

Financial Management

An examination of the principles and practice of financial planning and control. Analysis of the problems of resource allocation and asset management under conditions of uncertainty. Techniques of capital expenditure analysis, and analysis of funds flow.

Prerequisite: Administration 50.510.

● Administration 50.522W1

Macroeconomics for Management and Policy

An examination of macroeconomic theory and policy, with emphasis on the theoretical foundations of contemporary policy debates.

Prerequisite: Economics 43.100.

George Warskett and Stanley Winer.

● Administration 50.523F1

Microeconomics for Management and Policy

An examination of microeconomic theory and policy, with attention to public sector economics.

Prerequisite: Economics 43.100.

A.M. Maslove, George Warskett, and Stanley Winer.

● Administration 50.530F1, W1

Organizational Behaviour I

An examination of basic theories and approaches to the motivation of workers in organizations, the analysis of individual behaviour in organizations from the perspective of worker motivations, and the examination of current tools, such as job enlargement participation models and M.B.O. for improving worker motivation and coping with organizational change.

D.G. Swartz, V.S. Wilson, and Michael Prince.

● Administration 50.536F1, W1

Law of Public Authorities I

Introduction to basic legal principles, structures, and processes for the public administrator.

Character of law and public law; constitutional

framework; legal sanctions and basic principles of legal control. Statutory discretion from the administrator's point of view.

Prerequisite: Political Science 47.200.

R.D. Abbott.

● Administration 50.551F1

Quantitative Methods I

An introduction to the theory of measurement and various methods of data collection, causal analysis and inferential statistics.

Eugene Swimmer and Stanley Winer.

● Administration 50.552F1, W1

Quantitative Methods II

An examination of techniques and problems of single equation estimation. Students will be expected to devise their own research design and analyze quantitative data with the use of the computer.

Prerequisite: Administration 50.551.

Eugene Swimmer and Stanley Winer.

● Administration 50.567F1, W1

Public Sector – Private Sector Relations

An examination of basic theories and interpretations regarding the roles of, and interrelationships among, the state, corporations, labour unions, the professions, and other elements of the private sector.

Prerequisite: Administration 50.500.

Rianne Mahon, G.B. Doern, and Donald Swartz.

● Administration 50.568F1, W1

Policy and Decision Making

An introduction to major political, economic, and organizational theories of policy and decision making, and their relationship to applied policy analysis.

Prerequisite: Administration 50.500.

G.B. Doern, Rianne Mahon, and V.S. Wilson.

● International Affairs 46.507F1

Theories of Development and Underdevelopment

A comparative analysis of approaches to the study of development processes and underdevelopment, including structural-functional, neo-classical, Marxist, and dependency theories.

● International Affairs 46.508W1

Development Planning: Theory and Practice

Third World development plans and strategies and their impacts; techniques employed in development planning, including social cost-benefit analysis, budgeting, and problems in development administration.

● International Affairs 46.537W1

Macroeconomics in a Development Context

An examination of macroeconomic theory and policy in the context of the developing countries, with special emphasis upon theory and policy for open economies, structural adjustment to international disequilibrium, exchange rate and balance of payments management, fiscal and financial policy.

Optional Courses

● Administration 50.501T2

Policy and Administration in Intergovernmental Relations

An examination of the major cost-sharing and fiscal transfer agreements, and the intergovernmental mechanisms for policy and administrative coordination. Also examined are selected substantive program areas, such as immigration, cable television, manpower training, regional economic development, energy and natural resources, and other contemporary topics.

V.S. Wilson.

● Administration 50.502F1

The Political Economy of Regulation

An examination of political, economic, legal, and organizational theories of regulation in the Canadian and comparative context, and of the processes and consequences of regulatory practice in selected Canadian public policy fields.

G.B. Doern.

● Administration 50.513F1

Budget Decision Making and Budgeting

A study of selected aspects of the expenditure and revenue budget and budgetary process at all levels of government. Student papers are oriented towards critical review of actual budgets and budgetary processes.

Prerequisites: Administration 50.523 and 50.568.

G.B. Doern, A.M. Maslove, and Stanley Winer.

● Administration 50.514W1

Public-Sector Accounting and Finance

An examination of selected problems in accounting and financial management in public-sector organizations.

● Administration 50.515F1

Management in the Public Service

An examination through cases and research of selected problems and issues in public service management. The specific focus of the course will

change each year; some topics include human resources management, government investment, and pricing decisions.

● Administration 50.516W1

Urban and Local Government Management

An analysis of the principal issues and processes of Canadian urban and local government management and administration.

Michael Prince.

● Administration 50.517W1

Public Management in Developing Countries

An applied analysis of selected issues in public management and administration in developing countries.

N.H. Lithwick.

● Administration 50.518W1

Marketing for Non-Profit Organizations

Examination of the concepts of marketing relative to public demand, and the market for social goods and services. Contemporary marketing approaches and practices are analyzed and applied to purposes, programs, and environments of government agencies and departments, educational institutions, charities, and other public and social services. (Also offered as Business 42.518)

● Administration 50.519W1

Management of Public Enterprise

An examination of the theory and practice of public enterprise, drawing on both Canadian and comparative experience. The seminar examines selected federal and provincial crown corporations, and mixed enterprises, such as Air Canada, CNR, AECL, Telesat Canada, and the Canada Development Corporation.

● Administration 50.520F1

Public-Sector Investment and Pricing

An examination of theory and practice related to decision making about public-sector investment and pricing policy, particularly in connection with large-scale projects and programs. The focus is applied cost-benefit analysis (discount rates, marginal cost and shadow pricing, and the handling of risk and uncertainty) in large-scale public investment choices.

Prerequisite: Administration 50.523.

A.M. Maslove.

● Administration 50.528F1, W1

Management Information Systems I

An examination of the fundamentals of MIS: the nature of systems, information, and management processes, including concepts of data-processing technology, systems design, organizational impacts

of information systems, and hardware and software considerations.

● Administration 50.529W1

Management Information Systems II

The objective of this course is to provide the student with the tools to become an intelligent user and manager of an information system. Topics include: structured systems analysis and design; technology assessment; data analysis and design; and systems development life cycle. Students are required to present the results of a major case study of an information system.

Prerequisite: Administration 50.528.

● Administration 50.531W1

Organizational Behaviour II

An examination of macro open-systems theories of behaviour of organizations, including interagency and agency-clientele relations and accountability processes. Students examine through research papers different modes of organization, including ministry systems, state enterprise, mixed enterprise, regulatory boards, and service and custodial organizations.

● Administration 50.537F1

Law of Public Authorities II

Characteristics and problems of control of administrative action. Varieties of legal control, judicial review, discretion, privative provisions and damages, appellate control, statutory reform.

● Administration 50.538W1

The Management of Provincial Government

A comparative analysis of public-sector management structures and processes at the provincial level of government. Topics examined include personnel and financial systems, regional administration, public utilities, direct interprovincial program and project management, and international activities of provinces.

Michael Prince.

● Administration 50.562F1, W1

Planning and Evaluation in Government I

An examination of selected concepts, issues, and processes in applied governmental planning and evaluation, utilizing both Canadian and comparative experiences.

Sharon Sutherland.

● Administration 50.563F1

Program Assessment Design

An application of appropriate evaluative concepts to a public program or project in a bureaucratic setting. Working closely with the instructor, the student will design a feasible study/review of a program or project. Additional training in suitable methodologies will be acquired. The number of

students will be limited to the number of appropriate programs/projects in co-operating government departments available in any one year.

Prerequisite: Administration 50.562.

Sharon Sutherland.

● Administration 50.565T2

Government-Industry Policy Relations

An examination of the main policies, programs, and strategies of those government departments (federal and provincial) which have the most direct interface with the industrial and corporate sector in Canada. These departments include Industry, Trade and Commerce, Treasury and Economics, Consumer and Corporate Affairs, etc.

George Warskett and Rianne Mahon.

● Administration 50.566S1

Science and Technology Policies

An examination of Canadian programs, policies, and strategies toward the development of scientific and technological capability, and towards the use of science and technology in social and economic programs.

● Administration 50.569W1

Advanced Policy and Decision Analysis

Understanding the public sector through the building and application of public choice models. Topics include the theory of groups, representative democracy, special interest politics, the bureau, and federal structure.

Prerequisite: Administration 50.523.

A.M. Maslove and Stanley Winer.

● Administration 50.570T2

Policy Seminars

An examination of one or more selected policy areas. The focus will be an analytical assessment of the selected policy area in terms of its many-sided economic, political, social, legal, quantitative, and administrative complexities. The policy field will change each year.

● Administration 50.572F1, W1, 50.573S1

Policy Seminars

An examination of one or more selected policy areas. The focus will be an analytical assessment of the selected policy area in terms of its many-sided economic, political, social, legal, quantitative, and administrative complexities. The policy field will change each year.

● Administration 50.574F1

Urban Policy Analysis

An analysis of the urban policies of all three levels of government in Canada and their interactions. The course examines policy processes as well as a number of substantive urban policy issues.

N.H. Lithwick.

● Administration 50.575F1

Advanced Statistical Policy Analysis

An examination of econometric research on selected policy issues. The issues considered vary each year and the analysis incorporates the study of selected econometric techniques. The course enables students to evaluate critically applied econometric studies of public policy.

Stanley Winer.

● Administration 50.581W1

Staffing and Personnel Management

An examination of the staff and personnel-management functions in large public and private organizations, including recruitment, selection and performance appraisal, reward systems, and the roles of staffing professionals.

● Administration 50.583F1

Problems in Organizational Change and Development

An examination, through case work and group projects, of the concepts and issues of planned organizational changes.

● Administration 50.584F1

Industrial Relations and Collective Bargaining

An analysis of the basic concepts of industrial relations, with respect to both public- and private-sector employees and organizations.

Eugene Swimmer.

● Administration 50.585W1

Public-Sector Collective Bargaining

An application of the basic concepts, legislation, and public policies regarding public-sector collective bargaining at the federal, provincial, and municipal levels of Canadian government. Cases and simulated negotiations will be used where appropriate.

Prerequisite: Administration 50.584 or permission of the school.

Eugene Swimmer.

● Administration 50.590T2

Directed Studies

A tutorial or directed reading course on selected subjects.

● Administration 50.591, 50.592, 50.593F1, W1, S1

Directed Studies

A tutorial or directed reading course on selected subjects.

● Administration 50.595T2

Internship Paper

The internship paper is based on the internship placement, but must be distinct from it, and involves the application of relevant theoretical and

practical literature to the work assignment. It is developed in consultation with the student's faculty supervisor, and assessed by the faculty. Students should consult the Supervisor of Graduate Studies for details.

● Administration 50.597T2

Special Project in Development Administration

● Administration 50.598F2, W2, S2

Research Essay

● Administration 50.599F4, W4, S4

M.A. Thesis

School of Social Work

The School

Director of the School: Roland Lecomte

Supervisor of Graduate Studies: To be announced

The School of Social Work, accredited by the Canadian Association of Schools of Social Work in 1977, offers a graduate program leading to the degree of Master of Social Work. The program may be completed through full-time or part-time study.

Master of Social Work

The Master of Social Work program is based on an analytical and critical approach to social work practice, and to knowledge related to practice. The program examines the structural context of personal and social problems, and of social work practice. The structural context refers to the interaction between the personal and the social, political, and economic aspects of such problems. The program focuses on the development of forms of practice predicated on this notion, referred to as structural approaches, seeking to intervene to change the nature of the interaction between people and their structural context.

The school's orientation explicitly includes approaches to social problem solving, social development, and social change, which involves working directly with individuals and groups. This includes a strong emphasis on sensitivity to the individual, and on the development of new and innovative strategies for working with individuals in their environments. The school also stresses community analysis and an awareness and knowledge of the social policies that affect the lives of many people in our society.

The program of the school offers two major social work intervention areas. The first area is related to direct practice with individuals, families, groups, and communities. Pressures of society are contributing to the toll of family and individual suffering. Traditional primary institutions such as the family are undergoing modification, and in many cases they no longer provide needed support. It is hoped that skilled social work practitioners can help families, individuals, and communities through some of the crises, and help them to effectively address the personal and societal pressures they are facing.

The second major area of study is social administration and policy. There is a growing awareness that social work should be more involved in the development of social policies, in the operation of large scale social programs, and in policy analysis and research. Since the school is well situated in the nation's capital, it has a wealth of resources in the social-policy and program arenas to draw upon.

The program includes the following major curriculum segments:

- An understanding of social structure and individual and collective behaviour
- An understanding of the methods and processes of social work intervention
- An understanding of the social policy process and social work's participation in it
- Research knowledge and skills, and their application to questions dealing with social work practice, with particular emphasis on the evaluation of social work practice and programs
- Field work, an opportunity for students to test out aspects of the academic curriculum within a practice setting, and to work with professionals involved in social work and related fields.

Part-Time Degree Program

The school also has a small part-time degree program in operation. A limited number of candidates are admitted to this program each fall. It is anticipated that the part-time program will attract competent candidates who, due to a range of circumstances, cannot participate in a program of full-time study. M.S.W. requirements in the part-time program are identical to the regular program, and the course offerings and timetable for part-time students are the same as for full-time students. Part-time students are permitted to enrol in a maximum of two half-courses per term. They have up to eight years to complete the program.

Admission Requirements

Admission to the school is on a selective basis.

All applicants will have received their bachelor's degree, or be in their final year of undergraduate study prior to graduating from a recognized university; a high second-class standing at the undergraduate level is expected. Applicants must present a one-credit course in basic research methods, and they should have a background in the social sciences. Preference will be given to candidates with related work experience.

Social Science Requirement

Applicants with degrees in the humanities or related fields may be required to take make-up courses in the social sciences. Courses that address societal and personal issues will be considered as equivalent: for example, society, value, and technology; social and political philosophy; social history of Canada; contemporary Canadian cultures; media and society; public issues in Canada; and contemporary labour problems.

Research Requirements

Courses stressing logic of inquiry will be given preference. These may include courses in quantitative and/or qualitative research, philosophical as well as historical approaches to inquiry, and the standard social science research courses.

Program Requirements

Candidates for the Master of Social Work degree must complete 10 full credits of course work (or the equivalent).

All students must complete the courses Social Work 52.500 or 52.506, 52.510, either 52.551 or 52.552 (or one of the specified substitutes below), 52.561 (following the completion of four full credits taken in the school, which must include Social Work 52.500 or 52.506, 52.510, and either Social Work 52.520 or 52.540, or a substitution if advanced standing for any of these is granted) and Social Work 52.590.

Electives across the program, totalling 3½ credits, are to be accomplished through either a second (two-credit) field placement and the equivalent of 1½ credits of course work, or 3½ credits of optional course work from across the program.

In addition, *Direct Intervention* students must take Social Work 52.520 and two half-credits from 52.501 to 52.509, 52.521 to 52.529; and *Social Administration and Policy* students must take Social Work 52.540 and two half-credits from 52.501 to 52.509, 52.511 to 52.519, 52.541, 52.542.

Substitutes for Social Work 52.551 or 52.552 are: Sociology 53.512 and 53.513; Statistical Methods I and II; Anthropology 54.541; Anthropological Methods; Public Administration 50.562; Planning and Evaluation in Government I; Psychology 49.510 and 49.511; Research Methods in Social Psychology I and II; Psychology 49.545; Quantitative Psychology; Psychology 49.570; Research Methods in Learning; Political Science 47.573; Advanced Research Methods; Economics 43.505; Econometrics; Economics 43.592; Econometric Methods; and History 24.588; Historiography.

Academic Standing

The school operates within the evaluation and grading system of the Faculty of Graduate Studies and Research.

Graduate Courses*

The following courses are offered in the graduate program, but not all are available in each academic year.

Human Behaviour and Structural Context

● Social Work 52.500F1

Human Behaviour and Structural Context

A general framework for the utilization of social science theory in social work practice is presented, reviewing major contributions from individual and social psychology, and from social, political, and economic theory toward the understanding of the interaction between the personal and the larger social system aspects of problems confronted by social work practitioners. A major analytic focus of the course is the position of women in the family, the paid labour force, and the social services.

● Social Work 52.501F1

Community Structure

Examination of various theories of community behaviour and structure, developing a general framework for understanding the complexity of community behaviour, related to community practice.

● Social Work 52.502W1

Economics of Welfare

An examination of economic aspects of social policy, critically examining several theoretical approaches to the role of government in the financing of social policy. Review of the growth of federal government spending on social welfare, and an examination of the federal tax system and selected social welfare policies.

● Social Work 52.503W1

Foundations of Sexuality

A critical examination of psychological, social psychological, and sociological theories about the nature of human sexuality, and sexual identity and interaction.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Social Work 52.504W1

Social Work and the Law

Examination of the legal context within which social policy is developed, social programs presented, and social work practised, clarifying the philosophical basis of Canadian law, the relationship between law and the state, and the expression of the law in the judicial system. Special attention is given to a critical analysis of legislation concerning families and children.

- Social Work 52.505W1

Organizational Behaviour

Examination of contemporary theories and research related to organizational behaviour and change, focusing on bureaucratic and open systems theory towards the critical analysis of complex social organizations, and examining the relevance of such theory to organizations in the social welfare field.

- Social Work 52.506F1

Women and Welfare

This course aims to stimulate and develop critical appreciation of the changing status of women in Canadian society, in specific relation to the field of social welfare, and to develop awareness of the importance of sex differentiation as a key determinant in society. Using women as a primary source of data, the course will examine women as the major providers and consumers of the social services. It will also analyze the implications of social policy decisions for women. Thus, the importance of gender stratification as a major problematic inherent in traditional theories of social class, political economy, the state, ideology, and psychology will be explored. The resultant implications for professional practice at both direct-intervention and social-policy levels will be considered.

- Social Work 52.507F1

Foundations of Direct Intervention Practice

This seminar traces the philosophical and historical evolution of the competing paradigms underlying contemporary social work practice, with individuals, families, and collectivities. Most of the analytical content will be drawn from the philosophy of science and from the sociology of knowledge.

- Social Work 52.508F1

Social Deviance and Social Control

A consideration of classical and contemporary theories of deviance, elucidating the nature and theoretical bases of ideas about social problems which are of concern to social workers.

- Social Work 52.509F1, W1

Selected Topics in Human Behaviour

Seminar on a special topic, presented by a faculty member or a visiting professor. The seminar is based on current interests of faculty and students and availability of special expertise.

Social Policy Analysis

- Social Work 52.510F1

History and Philosophy of Social Welfare

An historical perspective on the development of social welfare policies and the practice of social work, presenting an analysis of such matters as the functions of welfare institutions, the historical relationships between welfare and work, the nature and terms of social provisions, the contrast between residual and institutional welfare policies, and the development of social work practice.

- Social Work 52.511W1

Social Policy Analysis

Based on a framework for the analysis of social problems, the course offers conceptual, theoretical, and empirical tools for the analysis of social policies in meeting social needs or resolving social problems in Canadian society.

- Social Work 52.513W1

Personal Social Services

Examination of a number of issues related to personal social services, including government jurisdiction, financing, access, rationing, present organizational structures, and the nature of services provided. Major current developments are examined, and a perspective on the future of personal social services developed.

- Social Work 52.514F1

Housing Policy

An introductory analysis of the economic and social aspects of housing. Issues include the nature of property, housing finance and construction, rent control, land assembly and development, and housing rehabilitation; also covers the genesis and current state of housing policy at all three levels of government, and the effect of government policy on the distribution of housing.

- Social Work 52.515F1

Poverty and Wealth

Critical examination of theories of poverty and wealth, in an attempt to explain the existence of poverty and the unequal distribution of income and wealth in Canada, then using the perspective developed to focus on existing and prospective Canadian social policies, such as guaranteed annual income schemes and wealth taxation.

- Social Work 52.516W1

Mental Health Policies

An examination of the major issues and questions faced by practitioners, researchers, and planners in considering public policy decisions in the mental health field, including issues of authority and equality, values, and political aspects.

- Social Work 52.517W1

Social Policies for Children

A critical examination of social policies in Canada specifically directed towards children, and their underlying social bases in relation to the economic system, the family, and child-rearing practices.

- Social Work 52.518F1, W1

Seminar on a Selected Service Field

In any one year, two additional half-credit social policy analysis courses may be offered, focusing on particular fields of service, such as corrections, mental health services, children's services, or health care services, and examining current programs, historical developments, and the major current issues or developments.

- Social Work 52.519F1, W1

Seminar on a Selected Service Field

(Same description as 52.518)

Direct Intervention

- Social Work 52.520T2

Direct Intervention

Presentation of a structural framework for social work practice, consonant with the changing paradigm underlying the profession over the past decade, articulating a model of practice, and examining the following aspects of the framework: assessment and interventive approaches; development of analytical and interactional skills; the helping process. Research questions and implications will be continually identified.

- Social Work 52.521W1

Individual and Family Intervention

The development of practice knowledge and skill related specifically to intervention with individuals and with families, examining the implications for assessment and intervention of a structural approach to working with individuals and families, and directing attention to the differential use of current techniques of intervention.

- Social Work 52.522F1

Models of Practice with Individuals and Families
Comparative and critical analysis of contemporary models, that is, "approaches", "intervention methodologies", etc., currently proposed in direct practice. An analytical framework is presented which examines the problems of selection and relevance of such models for a structural approach to practice.

- Social Work 52.523F1

Principles of Group Development

Group development refers to the changes through time in the internal structures' processes, and culture of the group. Based on the assumption that the group is a vehicle in all practice modalities, and that the role of the group leader is that of developing the group to do its own work, the course draws on small-group theory and group-practice theory.

- Social Work 52.524W1

Differential Application of Group Development

Examination of the application of group development skills in a variety of settings, with the concept of group development as a unifying theme; identifying significant interactional variables to form a comparative framework. The student will acquire knowledge in breadth, pertaining to the differentiation of group contexts, as well as knowledge in depth, pertaining to a selected group context.

Prerequisite: Social Work 52.523 or equivalent.

- Social Work 52.525W1

Building an Organization

The theory and practice of organizing for social action in a variety of contexts: at the theoretical level, the concern will be when and on what basis to organize. Specific attention is then given to organizing at the community and the institutional levels, and organizing national pressure groups around social policy issues. The development of skills will be undertaken in contacting the potential constituency, in constitution making and running meetings, negotiating, fund raising, public relations, building support among members, and planning effective actions to achieve or publicize organizational aims.

- Social Work 52.526W1

Models of Community Practice

Presentation of a framework for analysis of community problem definition, and working this through goal setting, decision making, action strategies, tactics and evaluation, affording a detailed examination of four major community intervention roles: enabler, organizer, developer, and advocate. The concept of citizen participation is also examined.

- Social Work 52.527F1

Case Studies in Community Practice

This course is concerned with community action in Canada, based on case studies of Canadian experiences, and providing a broad perspective of the types of citizen action and intervention in community processes; emphasis will be placed on practice, relating concepts developed to the past, present, and emerging reality of community work in Canada.

● Social Work 52.528W1

Feminist Counselling

A critical examination and analysis of approaches to women's problems by the helping professions in general, and social workers in particular, emphasizing the developing theory, practice, and literature of feminist counselling which endeavours to combine the personal and political aspects of women's experiences and alternative forms of helping.

● Social Work 52.529W1

Intervention with Children and Youth

Examines preventative and protective social work intervention with children and youth, analyzing the problems involved in neglect, violence and abuse, crisis situations, wardship, "taking-into-care", and problematic behaviours, in the context of the epigenetic stages of maturation, the family in its diverse forms, and the social-political context in Canada.

● Social Work 52.530F1

Social Change and Social Welfare

Exploration and analysis of the major factors in social change, drawing on the relevant work of major social theorists, and on writers such as Gorz, Alinsky and Freire, who have directed themselves more explicitly to issues faced by social workers.

● Social Work 52.531W1

Social Work with People in Conflict with the Law

An analysis of the theoretical framework and social work practice within the Canadian law enforcement apparatus and correctional services. The course emphasizes the role and participation of social work in new areas which deal with the problems of juvenile delinquency and crime.

● Social Work 52.532F1

Cognitive Approaches to Social Work Practice

An examination of a framework for cognitive and behavioural methods which allows critical analyses as well as intervention in the different areas of social work practice. This examination focuses on the link between the behaviour of the client systems (individuals, families, communities, and organizations) and the social structures, processes, and values which occasion it and which must be considered for effective service.

Social Administration and Policy

● Social Work 52.540T2

Social Administration and Policy

An introductory methods course, providing an understanding of the values and knowledge required for the effective performance of policy and planning roles in organizational and community settings, covering need assessment as well as administrative, policy, and planning methods, with

an emphasis on social welfare and health agencies as the system context for practice.

● Social Work 52.541F1

Management of Social Programs

Development of intervention and analytic skills through concern with the nature of management in the public and voluntary sector, approaches to more effective utilization of organizations and more effective mechanisms for the delivery of human services. Topics include managerial effectiveness, decision-making methods and tools, models of managerial behaviour, and the design of resource requirements, including budget development.

● Social Work 52.543W1

Supervision of Direct Practice

An analysis of the functions performed in the supervisory role in human service organizations, consideration of differential models of supervision, and examination of problems and issues in social work supervision.

● Social Work 52.544F1

Program Implementation Analysis

An examination of factors affecting social program implementation, and issues pertaining to the translation of policies and plans into program realities.

● Social Work 52.545W1

Industrial Relations and Social Work

The purpose of this course is to examine the relationship of employer and employee in social work. This requires an examination of the rise of human services and social work in particular, concomitant with development of a capitalist economy. It also requires an understanding of the development of an industry, unionization, and state intervention in industrial relations in order to situate social work in context. An examination of the current structure of unions and industrial relations legislation sets the stage for more detailed study of the growth of unionism, wages and conditions, contract bargaining, and particular contracts in social work. Particular contracts and conflicts are also examined.

● Social Work 52.549F1, W1

Special Seminar in Social Work Intervention

A special half-credit seminar in intervention may be offered each year, on a particular topic relevant to current interests of faculty and students (or a visiting professor), in either Direct Intervention or Social Administration and Policy.

● Research Planning Seminar 52.550F1, W1

● Social Work 52.551W1

Program Evaluation

Relying on principles of basic research methods,

this course will focus on the issues of planning and conducting research which aims to determine the effects of social programs. Topics include purposes of evaluative research, articulating program components, goal specification, development of measures, experimental and quasi-experimental design, and utilization of findings.

- Social Work 52.552W1

Evaluation of Direct Intervention

Development of a beginning awareness of issues and skills involved in the evaluation of intervention with individuals, families, small groups, and communities. Moving from philosophical and sociopolitical research perspectives, the seminar focuses on the development of evaluative criteria and analytical frameworks which could be used to determine the relevance and the effectiveness of intervention.

Field Practice — Full-Time

- Social Work 52.561F4, W4, S4

Field Practice I

The field placement facilitates the integration of the academic and practical aspects of social work education, providing the opportunity for students to test theory and practice models dealt with in the academic curriculum, and to learn professional responsibility in self-directed learning practice skills; includes a bi-weekly field seminar.

Offered in spring term subject to availability of faculty.

- Social Work 52.562F4, W4, S4

Field Practice II

Second placement students may receive placement supervision outside the normal geographical boundary.

(Same description as 52.561)

Prerequisite: Social Work 52.561

Field Practice — Part-Time

- Social Work 52.563F2, W2, S2

Field Practice I

(Same description as 52.561)

- Social Work 52.564F2, W2, S2

Field Practice II

(Same description as 52.561)

Independent Enquiry Project

- Social Work 52.590F2, W2, S2

Independent Enquiry Project

The IEP is designed to contribute to the preparation of social work practitioners through the development of skills in planning and conducting research relevant to social work practice. The IEP should include some common elements: formulation of a question; a rationale for the importance of the

question; theoretical basis for investigating the question. Various research approaches and styles may be used. The student works with a faculty research adviser and the proposal is reviewed by a project reader.

- Social Work 52.591F1, W1, S1

Tutorial on a Selected Topic

Tutorial or reading course on a selected topic.

Offered in spring term, subject to availability of faculty.

- Social Work 52.592F4, W4, S4

Independent Enquiry Project/Thesis

In special cases where resources permit, students will be allowed to undertake a two-credit independent enquiry project, instead of the one-credit independent enquiry project, Social Work 52.590.

Department of Sociology and Anthropology

The Department

Chairman of the Department: John Harp
Departmental Supervisor of Graduate Studies:
Stephen Richer
Associate Supervisor of Graduate Studies:
Jared Keil

The Department of Sociology and Anthropology offers programs of advanced study and research leading to the M.A. and Ph.D. degrees in Sociology, and to the M.A. in Anthropology.

The principal focus of departmental interest in sociology at the graduate level is comparative social organization, with complementary specialization in the study of social demography-ecology and theory-methodology. The research emphasis is on industrial and industrializing societies. The institutions of Canadian society — in particular, class, ethnic, political, and regional structures — are examined in historical and comparative perspective.

The principal focus of the anthropology graduate program is the exploration of current developments in analysis and theory. This emphasis upon theory and methodology leads to the exploration of such alternative approaches to anthropological analysis as functionalism, Marxism, behaviourism, and structuralism, among others. There is a strong ethnographic component, with particular emphasis on North American studies and a secondary emphasis on Africa.

The current activity of the members of the department is as follows:

Comparative Social Organization

Comparative Societies

Wallace Clement, John Harp, B.A. McFarlane,
Dennis Olsen, Adam Podgorecki, A.D. Steeves,
D.R. Whyte

Comparative Institutions

Florence Andrews, Wallace Clement, June Corman,
Colin Farmer, D.P. Forcese, Muni Frumhartz, John
Harp, F.K. Hatt, Gordon Irving, John Myles, Adam
Podgorecki, Stephen Richer, Daiva Stasiulis, Ian
Taylor, F.G. Vallee

Occupations and Formal Organizations

C.C. Gordon, D.P. Forcese, F.K. Hatt, Judah Matras,
A.D. Steeves

Social Stratification and Mobility

Monica Boyd, Wallace Clement, D.P. Forcese, F.K.
Hatt, Judah Matras, A.D. Steeves

Social Anthropology

Valda Blundell, Jacques Chevalier, J.J. Cove, B.A.
Cox, Jared Keil, Charles Laughlin, Joseph Manyoni,
J.I. Prattis, D.G. Smith, V.F. Valentine, F.G. Vallee

Social Demography-Ecology

Monica Boyd, Judah Matras, John de Vries

Theory-Methodology

Hyman Burshtyn, Jacques Chevalier, D.P. Forcese,
John Harp, B.D. Johnson, Gertrud Neuwirth, T.A.
Nosanchuk, J.I. Prattis, Stephen Richer, John
de Vries, Caryl Steffens, D.R. Whyte

The Department of Sociology and Anthropology has access to the Canadian Institute of Public Opinion poll data and the Human Relations Area Files, and is a member, in co-operation with other social science departments, of the Inter-University Consortium for Political Research. Other data sets and archival holdings are also available in the department. Because of the location in Ottawa of Statistics Canada, the National Museum, the National Library, the National Science Library, the Public Archives, and the headquarters of many government departments, the city is an excellent base of operations for sociological research.

The graduate program in anthropology enjoys an especially close relationship with the sociology graduate program and, while certain members of the department are primarily identified as anthropologists, a number of sociologists may also be called upon for particular contributions to the program. There are other valuable resources in the Norman Paterson School of International Affairs and the Committee on African Studies.

Qualifying-Year Program

Applicants with general (pass) bachelor's degrees may be admitted into a qualifying-year program designed to raise their standing to honours status. Students earning at least high second-class standing in their qualifying-year courses will be considered for admission into the master's program.

Refer to the general section of this calendar for details of the regulations governing the qualifying year.

Master of Arts in Sociology

Admission Requirements

The requirement for admission into the master's program is an honours B.A. (or the equivalent) with at least high second-class standing.

Program Requirements

Master's students in sociology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

Thesis Program

- Three full courses (or the equivalent); under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level. Sociology 53.589 is highly recommended, especially for students who at the time of registration have not decided on a thesis topic
- A thesis equivalent to two full-course credits
- An oral examination on the candidate's thesis and program.

Course Work Program

- Five full courses (or the equivalent) excluding Sociology 53.595; under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level
- Written and oral examination in the candidate's area of specialization and program.

Academic Standing

A grade of B — or better must normally be obtained in each course counted toward the master's degree. With the recommendation of the department, a candidate may be allowed a grade of C (but not C —) in one full course or each of two half courses.

Master of Arts in Anthropology

Admission Requirements

The requirement for admission into the master's program is an honours B.A. (or the equivalent) with at least high second-class standing.

Program Requirements

Master's students in anthropology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

Thesis Program

Three full courses (or the equivalent) to include:

- Anthropology 54.541
- Anthropology 54.542
- Two additional credits selected from the anthropology graduate course offerings; from courses offered in the sociology graduate program (especially in theory and methods); from 400-level courses offered in the sociology and anthropology undergraduate program (with permission of the graduate committee); or any combination of these selected in consultation with the student's graduate adviser. Courses in other programs in the University may also be selected (for example, Political Science 47.581), but not in excess of one full course (or the equivalent)
- A thesis equivalent to two full-course credits
- An oral examination on the candidate's thesis and program.

Course Work Program

- Five full courses (or the equivalent) excluding Anthropology 54.595, consisting of
- Anthropology 54.541
- Anthropology 54.542
- Four additional course credits as described in the thesis program above, chosen in consultation with the student's graduate adviser
- A written and oral comprehensive examination in the candidate's area of specialization and program.

Academic Standing

A grade of B — or better must normally be obtained in each course counted toward the master's degree. With the recommendation of the department, a candidate may be allowed a grade of C (but not C —) in one full course or each of two half courses.

Doctor of Philosophy in Sociology

The substantive focus of the Ph.D. program is the organization and development of modern societies, both in a comparative context and with particular reference to Canadian society.

The Ph.D. program in sociology normally will be undertaken on a full-time basis; however in exceptional cases the department will consider admission on a part-time basis.

Admission Requirements

The minimum requirement for admission into the Ph.D. program is a master's degree (or the equivalent) in sociology, normally with a minimum

average of B+ in courses (including the thesis where applicable), and with no grade below B.

Applicants who have deficiencies in certain areas may be admitted into the Ph.D. program, but will normally be required to complete additional course work.

Program Requirements

The specific program requirements of the Department of Sociology and Anthropology are the following:

- 10 full courses (or the equivalent), including 53.600T2 and 53.602T2, and a thesis equivalent to a maximum of seven full courses or a minimum of five full courses
- Written and oral comprehensive examinations in three areas of specialization
- An oral examination on the subject of the thesis and fields related to the candidate's Ph.D. program.

Comprehensive Examinations

Each Ph.D. candidate is required to write a total of three comprehensive examinations. At least one (but not all) of the three examinations will be undertaken in a sub-area of comparative social organization: the sub-areas are comparative societies, comparative institutions, occupations and formal organizations, social stratification and mobility, and social anthropology.

The remaining comprehensive examinations must be undertaken in:

- social demography-ecology, and/or
- theory-methodology.

An approved field in a related discipline may be substituted for one of the areas listed above.

The comprehensive examinations are normally undertaken after completion of at least one year of Ph.D. study, and must be successfully completed at least one term before the oral defence of the thesis.

Language Requirements

The Department of Sociology and Anthropology requires each Ph.D. candidate to demonstrate an understanding of a language other than English. Although French is the preferred second language, students may be permitted to substitute another language if it is demonstrably relevant to their professional interests. It is strongly advised, however, that all English-speaking candidates be proficient in French. The language requirements may be satisfied by a demonstration of reasonable understanding, on sight, of material contained in selected samples of the sociological literature in that language. Students may find it necessary or advisable to take a course in the required language before undertaking the departmental language examination.

Academic Standing

Candidates must obtain a grade of B- or better in each course and on the comprehensive examinations.

Graduate Courses*

● Sociology 53.500F1

Classical Sociological Theory

The course focuses on crucial sociological concepts and ideas proposed by the founders of sociology. Particular attention will be given to the contributions of Marx, Weber, and Durkheim; plus others such as Pareto, Comte, and Husserl. These will be situated within the philosophical, epistemological and social changes brought about by industrialization.

● Sociology 53.502F1

Contemporary Sociological Theory

The seminar will provide an analysis of major theoretical perspectives in sociology, including social behaviourism; social action theories such as symbolic interactionism, phenomenological sociology, ethnomethodology; and structuralist theorists such as structural functionalism, Neo-Marxism and Critical Theory. The seminar will focus on certain methodological and philosophical issues relevant to the analysis of the perspectives.

● Sociology 53.503W1

Selected Topics in Contemporary Theory

Topic for 1985-86: The Frankfurt School:

The critical Theory of J.Habermas

In the first part of the seminar the writings of J. Habermas will be discussed, beginning with *Structural Transformation of the Public Sphere* and including his latest work, *The Theory of Communicative Action* (1983). The discussion will focus particularly on his changing conception of critical theory and on his analysis of the structural transformation of capitalism. In the second part of the seminar his work will be critically evaluated in light of the recently published critical debates.

*F,W,S indicates term of offering.

Courses offered in the fall and winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

As this list of courses was prepared one year in advance of the commencement of classes, the department reserves the right to change the terms or cancel courses as required. Students are advised to consult the departmental timetable available in early July for up-to-date information.

● Anthropology 54.504F1

Ecological Anthropology

This course examines anthropological approaches to the study of human-environment relationships. Topics covered include the influence in anthropology of biological evolutionary theory, and the applicability for humans of ecological models derived from studies of non-human species. Research on the ecology of foraging and horticultural societies will be reviewed, and we will consider how results from such studies of other cultures may provide insights in understanding ecological relations and problems in our own society. Finally, the implications of ecological analyses for the making of social policy will be considered.

● Sociology 53.506F1

Economy and Society

The relationship between economic processes and social formations is examined. Emphasis is on the transition from simple to monopoly commodity relations, and the implications of this transition for the stability and change of industrialized societies. Implications for the socioeconomic development of peripheral societies, and the trend toward post-industrial formations in dominant industrial societies are explored.

● Anthropology 54.508W1

Structuralism

A theoretical and applied examination of the structuralist perspective as employed in anthropological analysis. The course explores both the general principles of structuralist theory and its techniques of application to concrete examples drawn from different societies and aspects of social life such as rituals, cosmology, legends, art, literature, films, commercial ads, food habits, and discourse in general. Emphasis is placed on the Levi-Strauss contribution to modern semiology, the understanding of symbolic activity, and its relationship to such other contemporary schools of social scientific thought as structural psychoanalysis and structural Marxism.

● Sociology 53.509F1

Philosophy of Social Science I

The seminar considers the philosophy of language and the basic elements of scientific method, such as the classification of the sciences, the concepts of value, cause and probability, induction and deduction, confirmation of hypotheses, and the concept of truth.

● Sociology 53.511T2

Research Design and Data Analysis

An integrated approach to the problems involved in the analysis of quantitative data; research design

and procedure and statistical inference are studied. Participants will be required to attend lectures in Sociology 53.370, as well as a discussion group for graduate students only. In addition to the work normally required in Sociology 53.370, graduate students must submit a research paper on a topic related to their interests.

● Sociology 53.512W1

Statistical Methods I

A course on multiple regression analysis, with a review of basic statistical assumptions and techniques, followed by a detailed discussion of multiple regression analysis as a statistical technique. Particular attention will be paid to the practical problems associated with regression analysis of sociological data.

● Anthropology 54.516F1

North American Native Studies

An anthropological examination of selected issues concerning traditional and modern Indian, Inuit, and Métis societies, with emphasis on the Canadian scene. The course will explore controversies surrounding social change, "modernization", and cultural autonomy. Debates over resource management, native rights, government policy, and women's status may be examined.

● Anthropology 54.517W1

Problems in North American Ethnohistory

This seminar will examine methodological and substantive problems in the history of Canadian native peoples. It will explore controversies concerning the impact of European penetration and colonial policies on inter-tribal relations, cultural identity, and other aspects of native life.

● Anthropology 54.522W1

The Anthropology of Underdevelopment

An anthropological analysis of theoretical and historically concrete issues in the study of variable economic systems ranging from domestic subsistence and peasant production to slavery and capital-dominated markets. Special attention is given to non-capitalist modes of production and social formations, theories of economic modernization, and anthropology's contribution to Marxian explanations of the causes and consequences of hinterland poverty and Third World underdevelopment. Debates over the relationship between the decision making, material provisioning, and cultural symbolising processes are also examined.

● Sociology 53.525T2

Canadian Society

A critical examination of sociological models of modern societies and their relevance to Canada.

Special attention is given to current research and its application to contemporary issues.

● Sociology 53.526W1

Sociology of Occupations and Professions

A consideration of the development of occupational recruitment patterns and manpower problems in developed and developing areas.

● Sociology 53.529F1

Sociology of Science and Technology

Study of the interaction among science, technology and change in modern societies.

● Sociology 53.530W1

Social Institutions I

Topic for 1985-86: Women and the Canadian

Economy: Research and Policy Issues

This course investigates the position of Canadian women in relation to the Canadian economy. A variety of perspectives will be examined in regard to the entry and exit of women from the labour force, occupational segregation in the paid labour force, type of work performed (part-time versus full-time) and wage inequalities. In addition, attention will be paid to general social policy issues and formal policy enacted by the state in regard to childcare, equal pay, equal work and work of equal value, and equal opportunities. The role played by unions and women's groups also will be discussed.

● Sociology 53.531F1

Social Institutions II

Topic for 1985-86: Sociology and Psychoanalysis

In this course we will examine the relationship between psychoanalytic and sociological theory. A particular focus will be on the work of feminist theorists.

● Sociology 53.532W1

The Labour Process

A consideration of the organization of work and production from feudal times to the present. The purpose of the course is to analyze the labour process in advanced capitalist societies by means of the historical comparative method.

● Sociology 53.533W1

Sociology of Education

The seminar generally concentrates on a specific topic within the larger field of the sociology of education. Among the topics considered will be the relations between education and other social institutions, the structure of educational opportunity, educational systems and organizations, and the sociology of learning.

● Sociology 53.536W1

Cultural Studies

A common element in new approaches to cultural

studies is making culture problematic. At the most general level, the object is to understand the relations between cultural practices and other practices in definite social formations. Within sociology there is a return to the classical problem of ideologies, acknowledging the influences of Lukacs, Gramsci, Althusser, Williams, and others. More specifically, the seminar deals with theories of knowledge, alienation and emancipation.

● Anthropology 54.538W1

Feminist Analyses

This course examines various theoretical frameworks which address the analysis of women in society. We will concentrate on recent attempts to fuse feminist and materialist analyses. Emphasis will be placed on the analysis of the sexual division of labour in the family and the economy. Both the anthropological and sociological literature will be utilized.

● Sociology 53.540F1

Political Sociology

An examination of the sociological dimensions of power, politics, and political behaviour. Particular attention is placed upon class politics, and the role of labour organizations in Canadian society.

● Anthropology 54.541F1

Anthropological Methods

An examination of the philosophy of social science and the basic elements of scientific methods, with particular emphasis upon the problems of anthropological field work.

● Anthropology 54.542W1

Explanatory Frameworks in Anthropology

An examination of theoretical and methodological problems in anthropological analysis. Alternative approaches to explanation and analysis in anthropology will be considered. These may include Marxism, functionalism, behaviourism, and structuralism, among others, at both the micro and macro levels.

● Sociology 53.544W1

Race, Ethnicity and Class in Contemporary Societies

Various theoretical approaches concerning the persistence and re-emergence of ethnic and/or racial groups will be examined. Particular emphasis will be given to the intersection and overlap of ethnicity and race with social class.

● Sociology 53.545F1

Power and Stratification

An examination of theories of elite behaviour, social class, and ideology.

● Sociology 53.554S1

Selected Problems of Political Economy I

A research seminar which will explore a selected topic from current research in political economy, such as:

- a) The Sociology of the State
- b) Developments in the Theory of Culture and Ideology
- c) Analysis of the Sociology of the Labour Market
- d) Developments in Socialist-Feminist Theory.

● Sociology 53.555S1

Selected Problems of Political Economy II

(Same description as 53.554S1.)

● Sociology 53.565F1

Demographic Analysis

A seminar devoted to the intensive study of analytical strategies and techniques employed in demographic research. Attention is also given to mathematical and statistical models used in demography, which are relevant to research in other areas of sociology.

● Sociology 53.584W1

Modern Marxist Theory

An examination of topics of theory and research in modern Marxist literature; the central focus is on problems of class analysis, the state, and politics in advanced capitalist societies.

● Sociology 53.585W1

Selected Topics in Sociology

Topic for 1985-86: Comparative Class Structure

A research seminar devoted to the empirical analysis of class structure, class consciousness, and the labour process in a cross-national comparative context. Students will undertake the preparation and presentation of an original research essay based on one or more national surveys recently completed in seven countries, including Canada. This will be an advanced course for students already familiar with related theory and research.

● Sociology 53.586F1

Selected Topics in Sociology

Topic for 1985-86: Crime, Law, and Ideology

A review of the developments in criminological theory and in the broad area of the sociology of law that have emerged out of the critique of "labeling theory", most notably in Europe. A particular emphasis of the course will be on the convergence of "deviancy theory" and Marxism on the one hand, and feminism on the other. An examination of the "heritage" of classical Marxist and feminist theories of law will provide the groundwork for an evaluation of the work of contemporary European and North American students of crime, law, and "deviance".

● Sociology 53.589T1

The Logic of the Research Process

An examination of the research process, including the phases of conceptualization, choice of indicators, sampling, data collection, and analysis. Published articles will be studied as exemplars of the range of possible research strategies.

● Sociology 53.590F1, W1, S1

Tutorial

● Anthropology 54.590F1, W1, S1

Tutorial

● Sociology 53.595F1, W1, S1

Course-Work Comprehensive in Sociology

Available for students in a course-work M.A. who by the third term in their M.A. program have not yet completed their written and oral examinations. Completion of this course does not reduce the formal requirement of five full courses.

● Anthropology 54.595F1, W1, S1

Course-Work Comprehensive in Anthropology

Available for students in a course-work M.A. who by the third term in their M.A. program have not yet completed their written and oral examinations. Completion of this course does not reduce the formal requirement of five full courses.

● Anthropology 54.596F1, W1, S1

Field Seminar

This course is concerned with the conduct of directed field research, by special arrangement (for individuals or groups), to be combined with readings and papers under the supervision of a faculty member. The course may normally be taken only once in a student's program.

● Sociology 53.599F4, W4, S4

M.A. Thesis

● Anthropology 54.599F4, W4, S4

M.A. Thesis

● Sociology 53.600T2, 53.602T2

Departmental Research Seminar

A forum for the discussion of ongoing research within the department. Working papers of faculty and advanced doctoral students are examined within the context of current theoretical and epistemological issues. A presentation is expected in the second year of a student's program. Required for first- and second-year students; other Ph.D. students still in residence are strongly urged to participate as well.
(53.600T2 is a prerequisite for 53.602T2. *Credit will be given for 53.602T2 only.*)

- Sociology 53.690F1, W1, S1
Tutorial
- Sociology 53.699F, W, S
Ph.D. Thesis

Courses Not Offered in 1985-86

- 53.501 Selected Topics in Classical Theory
- 53.507 Social Change and Economic Development
- 53.513 Statistical Methods II
- 53.514 Multivariate Analysis
- 53.515 Selected Topics in Social Research
- 53.520 Comparative Social Systems
- 53.521 Comparative Methods in Social Research
- 53.527 Sociology of Formal Organizations
- 53.534 Sociology of Law
- 53.535 Sociology of Religion
- 53.560 Human Ecology
- 53.566 Selected Topics in Sociology
- 53.575 Macro-Sociological, Demographic, and Ecological Problems
- 53.583 Departmental Seminar
- 54.587 Selected Topics in Anthropology
- 54.588 Selected Topics in Anthropology
- 53.601 Selected Topics in Sociology

The Institute

Director of the Institute: J.L. Black

An interdepartmental committee was formed in 1963 to foster teaching, research, conferences, and publications in Soviet and East European studies at Carleton. In 1970, a separate department — the Institute of Soviet and East European Studies — was established to administer the interdisciplinary programs developed by the committee. Faculty members from eleven disciplines (art history, economics, German, geography, history, international affairs, law, political science, Russian, sociology, and social psychology) participate regularly in the institute's activities. They are joined on an occasional basis by visiting scholars from outside the University, including invited specialists from the USSR and Eastern Europe.

At the undergraduate level, the institute offers an interdisciplinary B.A. honours program in Soviet and East European Studies. The institute also administers a program of studies leading to a Master of Arts degree in Soviet and East European Studies, the only one of its kind in Canada. The curricula for both programs are offered largely through participating departments. The M.A. program is designed for students wishing to acquire specialized knowledge of the Soviet and East European area, including proficiency in the use of Russian as a research tool; the approach is interdisciplinary with emphasis on the social sciences and history. Students may take advantage of the University's regular academic exchanges with post-secondary institutions in Hungary, Poland, and the USSR.

Qualifying-Year Program

Applicants who have a general (pass) bachelor's degree in one of the disciplines represented in the program, or who lack sufficient area studies or language training, may be admitted to a qualifying-year program designed to raise their status to that of honours graduates in Soviet and East European studies. Students are expected to achieve high second-class standing in qualifying-year courses in order to qualify for admission to the master's year.

To be eligible for admission to the qualifying-year program, an applicant must already have taken

some courses in the area of Soviet and East European studies, so that by the end of the program he or she will have satisfied the basic requirements for admission to the master's program. While language training can be offered as part of the qualifying-year program, students should have completed the equivalent of an introductory course in Russian upon entry.

Master of Arts

Admission Requirements

The normal requirement for admission to the master's program is an honours degree (or the equivalent) in Soviet and East European studies, with at least high second-class standing.

Honours graduates in other disciplines are eligible for admission provided they meet the following requirements:

- A knowledge of the Russian language sufficient for its use in research; in exceptional cases, the institute may permit the substitution of another Slavic or East European language.
- A total of seven full courses (or the equivalent) in the Soviet and East European field, taken in no fewer than three different departments
- At least high second-class standing.

Candidates with insufficient preparation in the Russian language or area studies may be admitted, but will be required to complete one or two additional courses. In some cases candidates may be required to enter the qualifying year.

Program Requirements

The specific requirements in the master's program are the following:

- Soviet Studies 55.500 and 55.501, two half-course seminars in Soviet and East European studies, offered specially by the institute, and incorporating the approaches of several relevant disciplines
- Two full courses, or the equivalent, chosen from the following list, with at least one full course (or the equivalent) at the 500 level. Students are advised to check with the relevant departments for final course listings for 1985-86, as changes in curricula may be made too late for inclusion below;

some of the following courses are not offered every year. Undergraduate course offerings below the 400 level may be taken by qualifying-year students, and by students in the M.A. program as supplementary to the minimum M.A. course requirements. (See the institute's program description in the undergraduate calendar for a list of these course options.)

Art History

- 11.420 Early Christian and Byzantine Manuscript Illustration
- 11.421 Early Medieval and Byzantine Ivories
- 11.425 Byzantine and Russian Icon Painting

Economics

- 43.470 Comparative Economic Systems
- 43.586 Comparative Economic Systems I
- 43.587 Comparative Economic Systems II

German

- 22.401 Formal German Speech

History

- 24.460 Selected Problems in Russian History
- 24.461 Selected Problems in Soviet History
- 24.560 Revolutionary Russia, 1898-1921
- 24.580 Problems in International History
- 24.589 Historiography (section dealing with modern Russia and USSR)

International Affairs

- 46.520 Studies in Strategy and Security
- 46.521 Studies in Strategy and Security
- 46.582 The Political Economy of East-West Relations
- 46.583 Political Economy of Eastern Europe

Law

- 51.420 International Economic Law II
- 51.463 Public International Law
- 51.563 International Law

Political Science

- 47.431 Marxist Thought
- 47.432 Contemporary Marxism
- 47.461 Soviet Foreign Policy
- 47.514 Comparative Communist Politics: Theory and Practice
- 47.515 Comparative Communist Politics: Selected Aspects
- 47.516 Selected Problems in Soviet Politics

Russian

- 36.405 Tutorial: History of the Russian Language
- 36.435 Tutorial: Special Topic (Literature)
- 36.445 Tutorial: Special Topic (Drama)
- 36.455 Tutorial: Special Topic (Post-1917 Period)
- 36.493 Translation Tutorial
- 36.494 Translation Tutorial II

Sociology

- 53.500 Classical Sociological Theory
- 53.545 Power and Stratification
- 53.584 Modern Marxist Theory

Soviet Studies

- 55.400 Aspects of Eastern Europe
- 55.401 Aspects of Eastern Europe
- 55.590 Tutorial in Soviet Studies
- 55.591 Tutorial in Soviet Studies
- 55.592 Tutorial in Soviet Studies
- 55.593 Tutorial in East European Studies
- 55.594 Tutorial in East European Studies
- 55.595 Tutorial in East European Studies
- 55.596 Tutorial in East European Studies

● One of the following:

Soviet Studies 55.598, a research essay incorporating the approaches of at least two of the disciplines represented in the program; the research essay must be combined with an additional full course (or the equivalent) chosen from those listed above

or

Soviet Studies 55.599, an M.A. thesis which must combine the interdisciplinary approach with a greater degree of originality than that required of the research essay, and which must be defended orally.

● An oral comprehensive examination to determine the candidate's general competence in the area, and his or her ability to relate at least two disciplines to the study of the USSR and Eastern Europe.

In both cases (55.598, 55.599) the paper should demonstrate that its author is capable of undertaking research in Russian, or in another language used in the Soviet Union, or in Eastern Europe.

In cases where, on admission, a student's command of the Russian language has been deemed insufficient, he or she may be required to pass an examination in Russian to English translation.

Academic Standing

Master's candidates must obtain a grade of B — on all work credited towards the degree.

Graduate Courses*

- Soviet Studies 55.500F1

Interdisciplinary Seminar on the Soviet Union and Eastern Europe

The themes of the seminar vary from year to year, but the continuing objective is to apply the approaches and methods of several relevant disciplines to selected issues and countries.

- Soviet Studies 55.501W1

Interdisciplinary Seminar on the Soviet Union and Eastern Europe

The themes of the seminar vary from year to year, but the continuing objective is to apply the approaches and methods of several relevant disciplines to selected issues and countries.

- Soviet Studies 55.590F1

Tutorial in Soviet Studies

A course of directed readings on selected aspects of the Soviet Union, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.

- Soviet Studies 55.591W1

Tutorial in Soviet Studies

- Soviet Studies 55.592S1

Tutorial in Soviet Studies

- Soviet Studies 55.593S1

Tutorial in East European Studies

A course of directed readings on selected aspects of Eastern Europe, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.

- Soviet Studies 55.594W1

Tutorial in East European Studies

- Soviet Studies 55.595S1

Tutorial in East European Studies

- Soviet Studies 55.596T2

Tutorial in East European Studies

- Soviet Studies 55.598F2, W2, S2

Research Essay

A research essay on some topic relating to the Soviet Union or Eastern Europe.

- Soviet Studies 55.599F4, W4, S4

M.A. Thesis

Other Courses of Particular Interest

Department of Criminology, University of Ottawa
CRM 63213 Crime and Criminal Policy in Communist Countries

Department of Political Science, University of Ottawa

POL 7605 Séminaire de Recherche en Politique Internationale

*F,W,S indicates term of offering.

Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

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B.W. Tansley, B.A., M.A. British Columbia, M.A., Ph.D. Rochester

W.B. Thorngate, B.A. California, Santa Barbara, M.A., Ph.D. British Columbia

J.W. Tombaugh, B.A. DePauw, M.A., Ph.D. Missouri

T.N. Tombaugh, B.A. DePauw, M.A., Ph.D. Missouri

R.L. Trites*, B.A. Gonzaga, M.A., Ph.D. Ottawa

W.E. Walther, B.A. Chico State, M.Sc. San Diego, Ph.D. Iowa

W.G. Webster, B.Sc. McGill, M.A. Cornell, Ph.D. Pennsylvania State

R.B. Wells, B.A. Reed, M.A., Ph.D. North Carolina

T.E. Whalen*, B.A. San Diego, M.A. British Columbia, Ph.D. Dalhousie

J.S. Wormith*, B.A. Brown, M.A. Carleton, Ph.D. Ottawa

R.M. Zacharko, B.Sc. Montréal, M.A., Ph.D. Saskatchewan

D.W. Zimmerman, A.B. Indiana, M.A., Ph.D. Illinois

School of Public Administration

R.D. Abbott, B.A. Carleton, LL.B. Queen's, LL.M. Harvard, of the Bar of Ontario

F.D. Abele, B.A. Calgary, M.A., Ph.D. York

A.J. Bailetti, B.Sc., M.B.A., Ph.D. Cincinnati

David Bellamy, B.A. Carleton, M.A. Queen's

G.B. Doern, B.Com. Manitoba, M.A. Carleton,
Ph.D. Queen's

D.W. Elliott, B.A. British Columbia, M.A.,
D.Phil. Oxford

W.P. Hettich, B.A. California, M.A., Ph.D. Yale

N.H. Lithwick, B.A. Western Ontario, Ph.D.
Harvard

Rianne Mahon, B.A. York, M.A., Ph.D. Toronto

A.M. Maslove, B.A. Manitoba, Ph.D. Minnesota

C.J. Maule, B.A. British Columbia, M.A. Queen's,
Ph.D. L.S.E.

W.A. Mullins, B.Sc. Portland, M.A. Arizona,
Ph.D. Washington

N.G. Papadopoulos, B.B.A. Athens, M.B.A.
Washington State

Michael Prince, B.A. Carleton, M.P.A. Queen's,
Ph.D. Exeter

D.C. Rowat, B.A. Toronto, A.M., Ph.D.
Columbia

Sharon Sutherland, B.A., M.A. Alberta, Ph.D.
Essex

D.G. Swartz, B.A. Queen's, B.Sc., Ph.D. Cornell

Eugene Swimmer, B.A. City College of New York,
M.A. Chicago, Ph.D. Cornell

Glen Toner, B.A. Saskatchewan, M.A. Alberta,
Ph.D. Carleton

George Warskett, B.Sc. London, M.Sc., Ph.D.
Queen's

V.S. Wilson, B.Sc. British Columbia, D.P.A.,
M.A. Carleton, Ph.D. Queen's

Stanley Winer, B.A. Carleton, M.A., Ph.D. Johns
Hopkins

Department of Religion

Nalini Devdas, M.A. Madras, B.D. Yale, Ph.D.
Bombay

J.P. Dourley, B.A. Ottawa, M.A. Toronto, Ph.D.
Fordham

A.R. Gualtieri, B.A., B.D., S.T.M., Ph.D. McGill

L.T. Librande, B.A. St. Louis, M.A. Syracuse,
Ph.D. McGill

R.E. Osborne, B.A. Sir George Williams, B.D.,
S.T.M. McGill, Ph.D. Edinburgh

R.M. Polzin, B.A. San Diego, Ph.D. Harvard

J.G. Ramisch, B.A. St. Mary's, M.A. Catholic
University of America

Eugene Rothman, B.A. Jerusalem, M.A.
Columbia, Ph.D. London

S.G. Wilson, B.A., Ph.D. Durham

School of Social Work

S.J. Albert, B.Sc., Carleton, M.S.W. Toronto,
D.S.W. Columbia

Michael Brake, B.A. Leeds, M.Sc., Ph.D. L.S.E.

Liba Duraj, B.A., M.A. T.C. Masaryk, M.S.W.
Carleton, Ph.D. Commenius

Peter Findlay, B.A. Western Ontario, M.A.
Washington at St. Louis

Kurt Fuerst, B.S.W., M.A., M.S.W. Manitoba, Dr.
Phil. Paris Lodron

Roland Lecomte, B.A., M.S.W. Ottawa, Ph.D.
Bryn Mawr

Helen Levine, B.A. Queen's, Diploma in Social
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Mary MacLean, B.A., B.S.W., M.S.W. McGill,
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Department of Sociology and Anthropology

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John Cove, B.A., M.A. Dalhousie, Ph.D. British
Columbia

Bruce Cox, B.A. Reed, M.A. Oregon, Ph.D.
California

John de Vries, B.A. Sir George Williams, M.S.,
Ph.D. Wisconsin

Colin Farmer, B.A., M.A. British Columbia

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ington at St. Louis

Muni Frumhartz, B.A. Toronto, A.M. Columbia

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John Harp, B.A. Saskatchewan, M.Sc., Ph.D. Iowa
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State, Ph.D. Alberta

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B.D. Johnson, A.B. Harvard, M.A., Ph.D. Califor-
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D.Phil. Oxford

Judah Matras, Ph.D. Chicago

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Adam Podgorecki, Law D. Jagiellonski, Ph.D.
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British Columbia

Stephen Richer, B.A., M.A. McGill, Ph.D. Johns
Hopkins

D.G. Smith, B.A. British Columbia, A.M., Ph.D.
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Michigan State

Caryll Steffens, B.A., M.A. Maryland, Ph.D.
North Carolina

Ian Taylor, B.A. Durham, M.A. Cambridge, Ph.D.
Sheffield

V.F. Valentine, B.A., M.A. Toronto

F.G. Vallee, B.A. McGill, Ph.D. London,
F.R.S.C., Professor Emeritus

D.R. Whyte, B.Sc. Manitoba, M.Sc., Ph.D.
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B.R. Bociurkiw, M.A. Manitoba, Ph.D. Chicago

R.L. Carson, M.A. Minnesota, Ph.D. Indiana

R.C. Elwood, M.A., Ph.D. Columbia

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don

Angelina Lewinson, M.Sc. Odessa, M.A. Ottawa

D.O. le Berrurier, Cands. H.A.A., Cands. Ph.H.S.,
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Nancy, Aix-Marseille

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Gertrud Neuwirth, Dr. Rer. Pol. Graz, Ph.D.
Minnesota

Adam Podgorecki, Law D. Jagiellonski, Ph.D.
Warsaw

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Radcliffe, Ph.D. Harvard

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Department of Spanish

Francisco Atienza, B.T. Salamanca, Lic. T.
Innsbruck, Lic. J.C. Rome, D.J.C., D.S.T.
Ottawa

Francisco Hernandez, Lic. Fa. y Letras, Barcelona,
M.A., Ph.D. Toronto

R.L. Jackson, M.A., Ph.D. Ohio State

José Jurado, Lic. Fa. y Letras, Dr. Fa. y Letras
Madrid

Ross Larson, M.A., Ph.D. Toronto

Angel López-Fernandez, Lic. Fa. y Letras, Dr. Fa.
y Letras Madrid

J.M. López-Saiz, M.A. British Columbia

C.A. Marsden, M.A., Ph.D. Cambridge

P.J. Roster, Jr., M.A., Ph.D. Rutgers

Department of Systems and Computer Engineering

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Syracuse

R.J.A. Buhr, B.Sc. Queen's, M.Sc.
Saskatchewan, Ph.D. Cambridge

D.C. Coll, M.Eng. McGill, Ph.D. Carleton

David Falconer, B.A.Sc. Toronto, S.M., Ph.D.
M.I.T.

M.A. Gullen, B.Sc. Edinburgh, M.S. Purdue

Faruk Hadziomerovic, B.Sc. Zagreb, M.E.E.
(NUFFIC) The Hague, Ph.D. Sarajevo

H.M. Hafez, B.Sc., M.Sc. Alexandria, Ph.D.
Carleton

S.L. Jansen, B.Sc., M.Sc. McMaster, Ph.D.
Connecticut

A.R. Kaye, B.Sc. London, M.Eng., Ph.D.
Carleton

Carl Kropp*, B.Sc. Queen's, B.Sc., M.Sc.
Carleton

S.A. Mahmoud, B.Sc. Ain Shams, M.Eng., Ph.D.
Carleton

D. Manfield*, B.Eng., Ph.D. Queensland

W.A. Malek, B.Eng. Carleton

L.R. Morris, B.A.Sc. Toronto, D.I.C. Imperial,
Ph.D. London

Bernard Pagurek, M.A.Sc., Ph.D. Toronto

R. Pandya*, M.Sc. Toronto, Ph.D. Carleton

T. Pearce, B.Eng. Carleton

J.S. Riordon, M.Eng. McGill, D.I.C. Imperial,
Ph.D. London

A.U.H. Sheikh, B.Sc. Lahore, M.Sc., Ph.D.
Birmingham

C.D. Stothart*, B.Sc. New Brunswick

F.S. Wong, B.Eng. Nat. University of Singapore,
M.A.Sc. New York, Ph.D. British Columbia

C.M. Woodside, B.A.Sc. Toronto, Ph.D.
Cambridge

The Institution

1941

The Ottawa Association for the Advancement of Learning was established to develop Carleton College. The next year the College offered only evening classes in introductory university subjects, with some courses in public administration.

1943

The incorporation of the Ottawa Association for the Advancement of Learning.

1945

Beginning of day classes and full-time teaching in arts, science, journalism, and first-year engineering. Establishment of the Faculty of Arts and the Faculty of Science.

1946

Move from rented premises to First Avenue campus, formerly Ottawa Ladies' College. First degrees awarded in journalism and public administration.

1947

The College committed itself to develop pass and four-year honours programs.

1949

First undergraduate pass degrees in arts, science, and commerce awarded. Formation of Senate.

1950

First honours degrees in arts and science awarded.

1952

The Carleton College Act, 1952 passed by the Ontario Legislature. This changed the corporate name to Carleton College and confirmed the power to grant degrees. Property for Rideau River campus acquired.

1953

Establishment of the School of Public Administration.

1954

Appointment of Architectural Associates for Carleton to prepare a master plan for Rideau River campus, and to design the first group of buildings. First honorary degree of LL.D. conferred on Dag Hammarskjöld, Secretary-General of the United Nations.

1955

First Master of Arts degree awarded.

1957

The Carleton University Act, 1957. Establishment of the School of Engineering. Establishment of the Institute of Canadian Studies.

1958

First Master of Science degree awarded.

1959

Move to Rideau River campus, following construction of the Henry Marshall Tory Building (science), the Maxwell MacOdrum Library, and Norman Paterson Hall (arts).

1961

First Ph.D. degree in science awarded. First degrees in engineering awarded.

1962

Southam Hall, the University Commons, Renfrew House and Lanark House (residences) completed. Norman Paterson Hall extended, and University Union opened.

1963

First Master of Engineering degree awarded. Reorganization into the Faculties of Arts, Engineering, Science, and Graduate Studies.

1964

The C.J. Mackenzie Building (engineering) completed.

1965

The E.W.R. Steacie Building (chemistry), Grenville House and Russell House (residences), Maintenance Building, and Heating Plant completed.

1966

First Ph.D. degree in engineering awarded. The Physics Building completed (designated in 1972 as the Herzberg Laboratories). Establishment of the Schools of International Affairs and Commerce.

1967

Loeb Building (social sciences) completed. Integration of St. Patrick's College as a division of the Faculty of Arts. Integration of the School of Social Work.

1968

First Ph.D. degree in arts awarded. First Master of Social Work degree awarded. Establishment of the School of Architecture.

1969

Controlled Environmental Facility (biology), Administration Building, Glengarry House (residence), and University Commons (residence cafeteria) completed.

1970

University Centre and Parking Garage completed.

1971

Arts Tower completed.

1972

Architecture Building completed. School of Social Work accommodated on the Rideau River campus.

1973

St. Patrick's College moves to new facility on the Rideau River campus. First degrees in architecture awarded. New athletic complex containing 50-metre pool and fitness centre opened. School of Industrial Design established.

1974

Faculty of Graduate Studies expanded into Faculty of Graduate Studies and Research. School of International Affairs renamed the Norman Paterson School of International Affairs. Master of Journalism program approved for September 1974. Master of Arts programs in anthropology and in religion approved for September 1975. Program leading to Certificate in Teaching of English as a Second Language established.

1975

Lester B. Pearson Chair for International Affairs approved for January 1, 1975. Establishment of Gerhard Herzberg Lecture Series in Science. First students enrol in public policy and management program offered jointly with the University of Ottawa.

1976

First Dunton Alumni Award presented, January 1976. Creation of the Paterson Centre in March 1976. Division of the Faculty of Arts into two separate faculties: the Faculty of Arts and the Faculty of Social Sciences, effective July 1976. First Master of Journalism degrees awarded, November 1976.

1977

Opening of the Criminology and Corrections Program at St. Patrick's College, April 1977.

1978

School of Continuing Education established. Credit courses offered on cable television for first time. Institute of Biochemistry established.

1979

St. Patrick's College ceased to operate as an academic unit of the University. Academic programs of the college continue as University programs, except for the Unified Liberal Arts Program.

1980

Establishment of the School of Computer Science. Establishment of the Chair of Office Automation in the Faculty of Engineering.

1981

Establishment of the Ottawa-Carleton Institute for Graduate Studies and Research in Chemistry, a joint program with the University of Ottawa. Establishment of a joint Ph.D. program in economics with the University of Ottawa.

1982

Establishment of the Ottawa-Carleton Centre for Geoscience Studies, representing the combined research strengths of Carleton University and the University of Ottawa, with programs leading to M.Sc. and Ph.D. degrees in most areas of geology. Establishment of a joint master's program in computer science with the University of Ottawa.

1983

Establishment of four joint graduate programs with the University of Ottawa: the Ottawa-Carleton Centre for Graduate Studies and Research in Biology; the Ottawa-Carleton Centre for Graduate Studies and Research in Physics; the Ottawa-Carleton Institute for Research and Graduate Studies in Electrical Engineering; and the Ottawa-Carleton Graduate Specialization in Neuroscience.

1984

Establishment of three joint graduate programs with the University of Ottawa in the areas of civil engineering, mechanical and aeronautical engineering, and mathematics and statistics.

Presidents

1942 — 1947

Henry Marshall Tory

1947 — 1955

Murdoch Maxwell MacOdrum

1955 — 1956

James Alexander Gibson (acting)

1956 — 1958

Claude Thomas Bissell

1958 — 1972

Arnold Davidson Dunton

1972 — 1978

Michael Kelway Oliver

January 1 — May 15, 1979

James Downey (*pro tempore*)

May 15, 1979 —

William Edwin Beckel

Chancellors

1952 — 1954

Harry Stevenson Southam

1954 — 1968

Chalmers Jack Mackenzie

1969 — 1972

Lester Bowles Pearson

1973 — 1979

Gerhard Herzberg

1980 —

Gordon Robertson

Special Lectures

Special Lectures at Carleton University

A.D. Dunton Alumni Award Lecture

This lecture series was established in 1974 in honour of Arnold Davidson Dunton, former President of Carleton University and Director of the Institute of Canadian Studies. The lecture is presented by a Carleton alumnus who has made outstanding achievements in his or her field.

The Davidson Dunton Research Lecture

Established in 1983, the Davidson Dunton Research Lecture is presented by a Carleton University scholar who is active in research and has achieved international recognition. The lecture is in honour of former Carleton University President Arnold Davidson Dunton.

The Walter L. Gordon Lecture

This lecture is sponsored by Carleton's Institute of Canadian Studies and the Canadian Studies Foundation in honour of Walter L. Gordon, former President of the Privy Council. The series was established in 1980.

The Gerhard Herzberg Lecture

Established in 1975 by the Faculty of Science, this lecture honours Gerhard Herzberg, former Chancellor of Carleton University and recipient of the 1971 Nobel Prize for Chemistry. The purpose of the lecture is to emphasize the relationship between science and society and to address an aspect of science which has a pronounced impact on our daily lives.

The Marston LaFrance Research Fellowship Lecture

The fellowship was established in 1979 by the Faculty of Arts in memory of Marston LaFrance, former Professor of English and Dean of Arts at Carleton University. Each year, the recipient presents a seminar or public lecture on some aspect of the research conducted while on fellowship.

The McMartin Memorial Lecture

The McMartin Memorial Lecture is presented in alternate years by the Department of Religion at Carleton University and the Faculty of Graduate Studies at the University of Ottawa. The series was established in 1969 and is funded by Mrs. J.P. Gilhooly of Ottawa in memory of her parents, Mr. and Mrs. John McMartin. The lectures involve themes which promote the importance of ethical, moral, and religious standards to education and living.

The Adam Mickiewicz Memorial Lecture

Established in 1969, the Adam Mickiewicz Memorial Lecture is presented each year by noted authorities in the area of Soviet and East European Studies. The series is sponsored by Carleton University's Institute of Soviet and East European Studies and the Adam Mickiewicz Foundation of Canada to commemorate Poland's foremost poet, Adam Mickiewicz.

The Lester B. Pearson Chair of International Affairs Lecture

Established in 1976, the chair is named in honour of Lester B. Pearson, former Chancellor of Carleton University and Prime Minister of Canada. The lecture is presented by the incumbent of the Lester B. Pearson Chair of International Affairs.

The Pickering Lecture

The Pickering Lecture is sponsored by the Department of Psychology at Carleton University and the Pickering Institute for Living in Ottawa. This annual lecture focuses on problems of developmental and childhood psychology.

The Alan B. Plaunt Memorial Lecture

The lecture was established in 1957 through a gift from an anonymous donor in memory of Alan. B. Plaunt, a distinguished Canadian who was active in many projects of national and civic importance in the 1930s. Each year, a Canadian, who is involved in contemporary issues and committed to a distinctively Canadian quality of life, is given the opportunity to speak out on any aspect of Canadian life.

The John Porter Memorial Lecture

This annual lecture is sponsored by the Faculty of Social Sciences in memory of John Porter, former Vice-President (Academic) at Carleton University and a distinguished sociologist. The series was established in 1982.

The Technology, Society, Environment Committee/Faculty of Arts Lecture

This lecture series was established in 1981 by the Technology, Society, and Environment Committee and the Faculty of Arts. The purpose of the annual lecture is to sensitize the public to the impact of technology on society and the environment.

The Philip E. Uren Memorial Lecture

The Philip E. Uren Memorial Lecture is sponsored by the Dean of the Faculty of Social Sciences in memory of Philip Uren, former Director of the Institute of Soviet and East European Studies, the Norman Paterson School of International Affairs, and the Paterson Centre for International Programs at Carleton University. This annual lecture was established in 1982.

